U. S. DEPARTMENT OF AGRICULTURE

AGRICULTURAL RESEARCH ADMINISTRATION

BUREAU OF ANIMAL INDUSTRY

and

COOPERATING WESTERN STATES

W-1 - IMPROVEMENT OF BEEF CATTLE THROUGH THE APPLICATION OF BREEDING METHODS

1953 Annual Report of W-1

and

Report of

Annual Meeting of Technical Committee

Laramie, Wyoming

July 24 and 25, 1953

This report is intended for the use of administrative leaders and workers and is NOT for general publication.

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ANNUAL MEETING
W-1 TECHNICAL COMMITTEE
Laramie, Wyoming
July 24 & 25, 1953

MINUTES

W-1 Technical Committee members present:

Arizona	Carl Safley
California	P. W. Gregory
Colorado	H. H. Stonaker
Hawaii	Oliver Wayman
Idaho	C. F. Sierk
Montana	F. S. Willson
Nevada	J. F. Kidwell
New Mexico	R. M. Durham
Oregon	Ralph Bogart
U. S. Range Livestock Experiment Station, Miles City	Charles Shelby
Utah	J. A. Bennett
Washington	M. E. Ensminger
Wyoming	P. O. Stratton
Regional Administrative Adviser	S. S. Wheeler
W-1 Regional Coordinator	C. B. Roubicek
National Coordinator	R. T. Clark
Bureau of Animal Industry	T. C. Byerly
Office of Experiment Stations	J. O. Grandstaff
Research Coordinator, ARA	H. W. Marston

The W-1 Technical Committee met on the University of Wyoming campus, July 24 and 25, 1953. The meeting was called to order by Chairman Gregory at 9:15 a.m. After introductions were made, Dean H. M. Briggs of the Wyoming Experiment Station graciously welcomed the committee and visitors.

The group then toured the wool, meats, and animal breeding laboratories. Mr. Stroble discussed the procedure used in blood typing beef cattle and answered questions of the group concerning present and potential status of the work.

The afternoon session opened with an address by Dr. L. M. Winters, University of Minnesota.

As I See It

Dr. L. M. Winters

It is indeed a pleasure for me to have this opportunity of meeting with you, the workers in the Western Regional Beef Breeding Project. I do not need to tell you that you are undertaking an extremely difficult task. The research itself, is of a nature that is slow to yield results and therefore, calls for the utmost in persistency; animal breeding and especially cattle breeding is no place for the "hot foot" type of researcher. The problems calling for information from research are numerous and complicated. Large numbers of animals are needed in order to conduct these researches. In spite of the number of years that we have been breeding livestock actually we have very little in the way of scientific background in animal breeding, at least in comparison with many other fields of activity. It is, therefore, but natural that we, the workers in the field, have quite divergent ideas as to the most likely avenues of success. Since then it is highly important that we develop a large, comprehensive and coordinated program calling into use the facilities and the talents of numerous stations, the task of synchronizing these varied facilities and talents becomes an enormous one and the success of this coordination is only in part the responsibility of the coordinators, but likewise the obligation of every cooperator. It does not mean, and should not mean, that each cooperator necessarily "sells his soul" to the bureaucrats, but each cooperator is under obligation to be willing to have his activities coordinated and he is also under obligation to stand for the things in which he believes. Furthermore, it is not asking too much that it be known on which team every man intends to play.

If anyone has any misgivings that I have come out here prepared to tell you how to breed better beef cattle or how to conduct your project, I wish to put him at ease because I have no intentions, whatsoever, of doing either one. In fact I came out fully convinced that I would take back more than I contributed to the conference. Those of you who have been my former graduate students, and I am happy to say that there are a number here of whom I am very proud, know that I do not, in my graduate teaching do much of telling "this is the right way and that is the wrong way" but what I try to do is to expose the student to information and let him work it out for himself. I happen to be a strong believer in self education.

What then do I propose to talk about. I thought perhaps it might be opportune to say something under the overall title "As I See It." I know, and as a matter of fact I hope, many of you will disagree with much that I am about to say. I say, I hope so, because it is my experience that when we agree with a speaker we go away and usually make a statement to the effect, well that was very pleasant, and then proceed to forget about the whole thing. It is when we disagree that the thoughts expressed stay with us; then we build up counter arguments and either end up by having built up good evidence against the statements made or else end up by being convinced that perhaps the other fellow had a point.

I think perhaps the first question it is well for us to ask ourselves is, why do we have research programs of the type we are meeting here to discuss? What are the major objectives of this type of research? I have my own ideas. My own ideas are colored to a large extent by the personal

knowledge I have of the personnel and forces that were to a large extent responsible for instigating at least two of these coordinated researches. I have particular reference to the Regional Swine Breeding Laboratory and to the coordinated Poultry study of crossing inbred lines. I have this knowledge because I had a very intimate association with each of the men who sparked the initiation of these two projects.

The former Dr. Andrew Boss, Vice-Director of the Minnesota Agricultural Experiment Station, dreamed of programs of this kind long before he was able to visualize the means whereby it would be possible to develop such programs. I know this because he talked to me about that sort of a program, particularly in swine but also in cattle, a number of years before the Regional Swine Breeding Laboratory came into being. I know what he thought such a program should accomplish. It was his opinion by the middle 20's that hybrid corn had already proved itself and that it was up to the animal breeders to find out how to utilize these same basic principles. In other words he sparked the initiation of the Regional Swine Breeding Laboratory because he believed that it was the responsibility of the varied experiment stations, Federal and State, to pool their facilities in order to learn how we might capitalize on these basic biological principles. He sold this view to a number of directors in the midwestern portion of this country. They, in turn requested the establishment of the Regional Swine Breeding Laboratory and as I understood, and do now understand, their objectives were, to give the various research workers the opportunity and the obligation of developing not only methods but materials that would prove of economic value to the swine industry.

A few years later the former Dr. Forrest Immer was vice-director of our Agricultural Experiment Station. On numerous occasions Dr. Immer discussed with me the need of finding out if some of the inbred poultry lines then in existence, might not cross to good advantage. Dr. Immer, himself, was trained as a corn breeder and he told me very frankly that the experiment stations had, to a large extent, failed to capitalize as fully as possible on their contributions to the development of hybrid corn. Dr. Immer conceived a coordinated program of testing the different inbred lines developed by the various experiment stations with the expectation that some of them would cross well and that due credit might then be given the agricultural experiment stations of this country and at the same time render a worthwhile service to the poultry industry of the country.

I would not leave the thought that I maintain that Dr. Boss established the Swine Breeding Laboratory nor that Dr. Immer was solely responsible for the poultry testing station but I do know that both of these men made the initial moves for both of these two programs. I do not know the processes by which the beef cattle, the sheep breeding and dairy cattle breeding programs came into being but I am inclined to believe that they were all initiated and financed on the basis of similar expectations. In my opinion, you cannot in this work separate methods and materials. Materials are necessary to prove the methods, but the materials lose much of their value if we have no satisfactory account of the methods.

This then brings us to the question, in my opinion too often a controversial one, of the comparative virtues of applied research and basic research. For my own part I have never felt that I need offer any apology because I am working in applied research; nor do I feel that we should belittle basic research. We, the workers in applied research, need basic research and the workers in basic research need applied research. There is an interdependence of the two. Basic research can obtain many leads from applied research and certainly applied research must rest on basic research. If I wanted to be in truly basic research I would get in basic research but by and large we, the workers in the animal field, are working in applied research. As far as I am concerned it is silly to pretend otherwise. Now as to just where basic research ends and applied research begins, I will leave for someone else to state because I do not know. In fact I am inclined to believe that it does not make a great deal of difference so long as we attempt to get the facts.

I have now stated my belief that all of these animal breeding programs were set up and financed with the expectation that we would develop methods and materials for the improvement of the branch of the livestock industry concerned.

How then are we to achieve these ends? For my own part I approach the job by accepting the concept of heterosis and I also accept the concept of using inbred lines for crossing. Now I hope no one will read into these two acceptances more than is intended. I did not state that everything crossed would yield hybrid vigor nor did I state that all inbred lines would cross to advantage. I do, however, accept and believe in these two basic concepts and I further believe that it is our job as animal breeders to learn how they may be applied to best advantage to the job at hand.

All my theory and experience convinces me that, we, working with the larger livestock, must have superior lines in order that they be of value to us in crossing, and both my logic and experience convinces me that lines wide apart genetically make, on the average, better crosses.

I realize that both of the above assertions are contested points. It is well for us to remember that we are now discussing a point that is not only a biological problem, but an economic one. Corn breeders have used to advantage some lines that were quite low in their productive value. The difference in the degree of fertility between corn and cattle is extremely wide. There is also a vast amount of difference between the investment in a corn plant and a breeding beef animal. One kernel of corn that grows into a corn plant which when fertilized will normally produce some 1300 to 1500 kernels or potential plants. Inbreeding can reduce the production of these kernels to 25 or 30% of the number ofkernels on an ordinary ear and yet leave the corn breeder with an increased fertility ratio of 1 to 300-400. Let us contrast this with cattle. A 90% calf crop is not considered bad. Normally we expect half of this calf crop to be bulls and the other half heifers; so here we have a normal fertility ratio of 1 to less than 1/2. It is not necessary to go to a ten-bank calculating machine to see what a reduced fertility to about 25% of normal would do to a cattle breeding project.

Even in swine with a litter size of 8 to 10 pigs a reduction in fertility to 25% of the normal would soon put the breeder out of business. A higher degree of fertility and lower value per breeding unit in poultry places poultry closer to corn in this respect than is possible for any of our four-footed farm animals.

Why the width in genetic base between lines to be crossed? The answer is simply, that the wider the genetic base the greater the likelihood of the lines possessing more genes that differ one from the other and furthermore because there is a vast amount of experience and evidence bearing on that point. In Dr. England's study of the effect of width of crossing on the amount of increased hybrid vigor he found that wide genetic crosses yielded a 13.19% superiority over the parental, whereas narrow crosses yielded only 8.64% superiority.

Both my own experience and observations, not only of experiment stations but of work in the field coupled with theoretical considerations, convinces me that the best foundation for the development of superior inbred lines is a good cross-bred foundation. I realize that there are those to whom this sounds like something close to rank heresy but actually it is merely voicing belief and confidence in the opportunities provided by segregation. It seems to me that we either believe in or do not believe in basic biological laws. The principles of segregation were clearly put forth by Mendel in his original paper. The possibilities of building up recombinations have been dealt with most effectively by Dr. Edwin Anderson. It seems to me that too often we try to make things too hard for ourselves. The very simplicity of the principle of segregation very likely is the reason why it seems to be so often overlooked in the development of some of our newer theories regarding improvement.

I am a firm believer in the most rigorous selection of both lines and individuals on the basis of performance. I am not very much interested in the average amount of improvement that is made by selection for performance. I am however intensely interested in the maximum amount of improvement that has been made when selection has been pointed toward performance. If we are going to be serious about our attempt to improve upon anything, whether it is methods of breeding beef cattle, building better airplanes or better A-bombs it is not the average that should be of major concern but the most successful for this is what will help to guide us to still better procedures.

Again both my observation and experience convinces me that we will be more successful in the development of inbred lines if we advance the coefficient of inbreeding rather slowly and particularly so while we are in the stage of about 15-25% of inbreeding. It seems that it is at this stage that we are doing the most in shaking up gene combinations and resorting them in new groupings. This is the reason I now prefer to advance rather slowly through this particular state of inbreeding. We can at best produce so small a segment of the possible recombinations of genes that we should produce as many as possible. By going slowly we will produce more types.

Another point in this connection, "How large in numbers should a line be? and "Is it better to develop one or two lines with large numbers or try many lines each with only a few animals." I will place my bets on the prospects of the line with large numbers over those of the same number of animals divided up into a number of small groupings. With small groupings you have so little opportunity for maneuver and this is very important in developing an inbred line. Lines with small numbers seem to breed very well on 10-bank calculating machines, but rather poorly in the lots where livestock is bred.

The question that is frequently raised is, "What is the optimum degree of inbreeding?" Frankly, I do not know. My own belief is, that there is no single answer to that question. It is going to differ with species, breeds and strains, but again my observation indicates that there is very little if any benefit at this time in carrying the coefficient of inbreeding much if any beyond about thirty percent.

I am personally more concerned about the gene-complex than with individual genes but individual genes make up the gene-complex so we must be interested in individual genes. Furthermore, the excellent piece of research that has been conducted by Dr. Gregory and his co-workers should awaken all of us to the need for a broader perspective of the application of genetics to animal breeding than some of us have been taking in recent years. I wish to go on record as stating that I am very much impressed with the contribution that this group of workers is making to not only beef cattle breeding but animal breeding generally. When a condition such as dwarfism reaches the point where some of our so called best herds are producing 25% and even more of dwarfs and when some of our commercial herds are yielding high percentages of dwarfs, it is a rather sad indictment of the leadership that has prevailed in this industry. Furthermore, the time has long passed for "fence straddling."

I will be very much surprised if during the years to come the explanations by Dr. Gregory and co-workers are not enlarged upon and perhaps even modified. It would indeed be strange if such were not the case, but if we are to wait until the last shred of evidence is in and until we have evidence so overwhelmingly conclusive that there can be no question of its complete accuracy then we have passed the time when there is need for the information. A close friend of mine served as statistician to our air force in Britain during the past war. He told me that if the U. S. Air Force in testing two procedures found that one yielded only 1% more favorable results than another method that they then were ready to use the method that yielded the higher percentage. The reason was that it might save a life or lives. I am afraid that sometimes we quibble too much about the amount of evidence we must have. And also the kind of evidence. In the main we are working in developmental research.

To return to the principle of dwarfism. It takes some intestinal fortitude to work hard and come up with something that you know is a contribution to the field only to have those from whom you have a right to expect constructive criticism jump on it and tear it apart like a pack of wolves. I ought to know because I have enjoyed some of that

myself. It was only thirteen years ago that I returned from a meeting in the West to find myself confronted with an angry administrator who pounded the desk and told me "As long as you are on this staff I never want to hear another word out of you on crossbreeding." My reply was that I was very sorry but I had no intentions of complying with this directive because I was a staff member of an institution that had gone on record as proclaiming academic freedom and furthermore I had my own ideas of my obligations to society. It was not many years later that this administrator apologized many time for his unfortunate demand and he and I became very close friends.

A few years later another administrator accused me of being a promoter rather than a researcher. I have reason to believe that this administrator has also lived to regret that statement. He, however, happens to belong to that variety that is not big enough to admit a mistake.

Let us return for a moment to basic genetics and its application to animal breeding. We have been hearing a great deal as to the causes of hybrid vigor. Is it brought about as the result of piling up more additive gene effects or is it brought about by gene interaction? I am sure that it is fine that we have people who concern themselves with these respective basic problems but from the standpoint of the animal breeder I cannot get overly concerned regarding the heterosis that arises from additive effects as contrasted with that from gene interaction. The reason I cannot get too excited about it as a practical problem is, that, in my opinion, both enter into the production of heterosis. I am inclined to believe that we will find it difficult, if not impossible, to separate the two.

This leads us to another basic consideration, how do genes act? In the light of the information that is available today I like to visualize them as a series of unfolding chain chemical reactions. In my opinion, no student should be allowed to receive his B.S. degree with a major in animal husbandry without having had at least one good thorough course in embryology. How anyone could go through a basic course in genetics and basic work in embryology wherein he followed the unfolding of body form and the development of organology without being fully convinced of the interaction of one gene with others and all genes with environment is, I believe, beyond comprehension. This has no direct concern to the problem of breeding better beef animals but sound basic information is indispensable in laying a foundation of applied research. If we are to make progress we must start training the coming generation so they are better equipped than we were. Time spent curling hair and training horns would be better spent learning about genes, organology and the management of a livestock enterprise.

In closing I will return to a statement that I made at the outset, namely, that applied research is dependent upon basic research but basic research in turn needs applied research. There is an interdependence of the two that should not be minimized.

W-1 ANNUAL REPORT, REGIONAL CATTLE BREEDING LABORATORY Date June 30, 1953

1. Station: University of Arizona

2. Title of Project: Progeny Testing of Hereford Sires

3. Facilities, Animals, and Personnel used in Project (with animal inventory shown by breed, sexes and age classes).
   a. Facilities. The Empire Ranch at Sonoita, Arizona and the Arivaca Ranch, Arivaca, Arizona, are listed as cooperating agencies. The breeding project was started on the Empire Ranch in 1948, and the herd was equally divided between the two ranches during the year 1951-52.
      (1) Empire Ranch, Sonoita, Arizona.
         (a). Pasture land to accomodate livestock as inventoried below.
         (b). Buildings and equipment essential for management of range livestock.
      (2) Arivaca Ranch, Arivaca, Arizona.
         (a). Facilities comparable to those provided by the Empire Ranch.
      (3) University of Arizona.
         (a). Thirty individual feeding pens.
         (b). Livestock scales.
         (c). Feedlot equipment.
   b. Animal inventory (hereford breed only).
      (1) Empire Ranch
         (a). Herd bulls (12 mo. or over)- - - - - - - - - - - - 4
         (b). Cows (2 years or over) - - - - - - - - - - - - - 88
         (c). Heifers (yearlings) - - - - - - - - - - - - - - - 27
         (d). Bull calves (est.)- - - - - - - - - - - - - - - - 36
         (e). Heifer calves (est.)- - - - - - - - - - - - - - - 39
      (2) Arivaca Ranch, Arivaca,Arizona.
         (a). Herd bulls (12 mo. or over) - - - - - - - - - - - 4
         (b). Cows (2 years or over) - - - - - - - - - - - - - 82
         (c). Heifers (yearling) - - - - - - - - - - - - - - - 27
         (d). Bull calves (est.) - - - - - - - - - - - - - - - 32
         (e). Heifer calves (est.) - - - - - - - - - - - - - - 39
   c. Personnel
      (1) University of Arizona
         (a). E. B. Stanley, O. F. Pahnish, C. E. Safley

4. Progress Since Last Annual Report
   a. Feedlot performance tests on prospective sires were continued.
   b. An investigation of the merits of a modified lignin ratio technique for the determination of digestibility was initiated.
   c. Feedlot performance tests on prospective herd sires were conducted on a time-constant and condition-constant basis simultaneously.
   d. Water consumption data was obtained in conjunction with the feedlot performance tests.
   e. The assignment of condition scores as well as conformation scores at weaning time and at 18 months of age was continued.
   f. Wither height measurements were continued and sternum height measurements at weaning time and at 18 months were incorporated.

g. Head profiles were obtained on all herd sires.

5. Summary or Conclusions.
   a. The analyses of the data obtained during the past year are incomplete.

6. Work Plan for the Future.
   a. Continuation of the present program emphasizing the evaluation of breeding stock through selection indexes.

7. Publications Anticipated.
   a. A Comparison of Selection Differentials When Various Methods of Selection are Employed. (Manuscript in preparation).
   b. An Evaluation of Conformation Scores Used in the Selection of Replacement Heifers (Manuscript in preparation).

8. Estimated project expenditures to date, by years.

	Funds				
Year	9-b-1 &2	9-b-3	Bureau	State	Total
1948-49	800	1600	1800	1800	6000
1949-50	1000	2600	1800	1800	7200
1950-51	740	1281	1800	2800	6621
1951-52	1000	4779	1800	1800	9379
1952-53	1000	2500	1800	1800	7100

INFLUENCE OF SELECTIVE PROCEDURES

University of Arizona

Selection of replacement bulls

This has been a cooperative project since the beginning Because of a limited number of performance tested bulls of suitable type for the cooperators, it was necessary to bring in two bulls from another herd. These two bulls, numbers 6 and 7 in this report, were of the same breeding and from the same ranch as all the replacement bulls that have been purchased for this herd for many years. A very similar type has been maintained.

Two bulls, numbers 34 and 35 in this report, came from within the cooperative herd. They were selected on the basis of a high total index score. See page 2 for the index used.

Selection of replacement heifers

All heifers have been retained in the herd until two years of age at which time replacement heifers were selected, with a few exceptions, on the basis of total index score. See page 2 for the index used.

Beef Cattle Selection Indexes that have been used at the University of Arizona
(Symbols are omitted for easier reading)

Selection index for calves within a sex = $\frac{\text{Deviation of corrected}^{1}\text{ weaning weight from average}^{2}\text{ corrected weaning weight}}{\text{Standard deviation}^{2}\text{ of corrected}^{1}\text{ weaning weight}} + \frac{\text{Deviation from average}^{2}\text{ conformation score at weaning}}{\text{Standard deviation}^{2}\text{ of conformation score at weaning}}$

Selection index for calves between sexes = $\frac{\text{Deviation of corrected}^{6}\text{ weaning weight from average}^{7}\text{ corrected weaning weight}}{\text{Standard deviation}^{7}\text{ of corrected}^{6}\text{ weaning weight}} + \frac{\text{Deviation from average}^{7}\text{ conformation score at weaning}}{\text{Standard deviation}^{7}\text{ of conformation score at weaning}}$

Selection index for replacement heifers that have been on the range = (Selection index for that calf, within a sex) + $\frac{\text{Deviation from average corrected}^{8}\text{ 18 month heifer weight that year}}{\text{Standard deviation of corrected}^{1}\text{ weight of heifers at 18 months}^{5}} + \frac{\text{Deviation from average conformation score of heifers at 18 months that year}}{\text{Standard deviation of conformation score of heifers at 18 months}^{5}}$

Selection index for 18 month old animals that have been on efficiency tests, either sex = (Selection index for that calf, within a sex) + $\frac{\text{Deviation}^{3}\text{ from average}^{4}\text{ T.D.N. per pound of gain}}{\text{Standard deviation}^{4}\text{ of T.D.N. per pound of gain}} + \frac{\text{Deviation from average}^{4}\text{ conformation score at end of feed test}}{\text{Standard deviation}^{4}\text{ of conformation score at end of feed test}}$

Selection index for cows = Use the index for their calf as calculated between sexes....or, if they have produced more than one calf, use the average between-sex index for her calves.

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1. Corrected for age and age of dam only
2. All calves of that sex for that year
3. Reverse the signs
4. Of thos animals that were feedlot tested (of that sex)
5. That year
6. Corrected for sex of calf as well as individual age and a ge of dam
7. All calves of both sexes for that year
8. Corrected for age only

Culling procedure for cows

All cows were automatically culled at nine years of age. Younger cows were culled, with a few exceptions, because of unsoundness or because of low production as determined by a total index score. The cows' index is determined by averaging the indexes of all calves she had produced up to the time for culling. See page 2 for the index used.

Weight and dollar value

As a means of seeing what has happened in this herd since 1948, the range in weaning weights between sire groups and average weaning weights for each year's production are summarized in the table below. Estimated dollar value of the calves in also included and shown in more detail on graphs 1, 2, 3, 4, and 5.

	Range for average weaning weights between sire groups	Range for weaning weights	Average weaning weights for each year	Estimated dollar value*
1948	87 lbs.	120 lbs.	418 lbs.	$117.84
1949	57 lbs.	140 lbs.	483 lbs.	$131.26
1950	42 lbs.	106 lbs.	489 lbs.	$130.88
1951	38 lbs.	133 lbs.	452 lbs.	$115.32
1952	28 lbs.	91 lbs.	508 lbs.	$134.42

The decrease in the range of weaning weights between sire groups indicates that the elimination of low-producing sires plus elimination of the extremes in replacement heifers by use of an index, and culling cows on the basis of their production has resulted in somewhat more uniformity of production. The decrease in range of weaning weights between sire groups appears to be due largely to the elimination of low producing sires 3 and 5.

There were no previous records on the four bulls that sired the 1948 calves. See graph number 1.

Sire 5 (graphs number 1 and 2) was outstanding from the standpoint of type but proved to be one of the poorest producers to date. He was eventually dropped for that reason after testing him three years.

Sire 3 was dropped the first year because his calves did not measure up to the other calves from the standpoint of type.

* Dollar value estimated on the basis of a 400-pound calf that scored 9.0 being worth 30 cents per pound. Also that .5 of a score is about equal in value to 50 pounds of beef.

Sire 2 was crippled after one year of service hence was not used any more.

Sire 4 was an outstanding producer and was kept in the herd until he was retired because of age.

Sires 8 and 11 were added to the herd for the 1949 calf crop although they had no previous record. See graph number 2. Sire 8 was a very typy son of the high-producing number 4. Sire 11 was used primarily because of his scale and reggedness. Some of this scale and ruggedness was apparently transmitted to his offspring as he consistently produced the heaviest calves.

Graph number three shows the addition of an outside, untested bull, number 7. This bull was used as there was not a performance tested bull of suitable type available from within the herd.

Graph number 4 shows that total production was low, possibly because of drought conditions on the ranch. Sire 34, a performance-tested bull from within the herd, was used as a herd sire on the basis of a high index score. This bull had an extremely high calf index and an above average feedlot index to give him the highest total index of all the bulls fed from the 1948 calves. He was a son of the high producing number 4 sire. Although his feedlot index was not outstanding he was used partly because of his total index score and partly on the basis of the New Mexico and Colorado work that showed the maternal grandsire may have a large influence on the weaning weight of calves. It looked like we would not be losing anything and we are expecting his daughters to be above average producers.

For the 1952 calves the second untested, outside sire (number 6) was added to the herd. See graph number 5. Number 35, a son of 8 and a performance-tested sire, was also added because his high index indicated he would be superior to Sire 8. His index was well balanced, being high above the average in weaning weight, weaning score, feedlot efficiency and type score at the end of the feeding period.

Application of selection indexes to selection by the practical cattleman

Our data has shown that selection of replacement heifers by index resulted in larger selection differentials for weaning weight and for 18-month-old weight than did selection by visual observation. Selection differentials for weaning score and for 18-month-old score were not appreciably different for the two methods of selection.

Further, or data shows there is a difference in weaning weight between sexes and a difference in weaning weight between dams of different ages. These differences are similar to those reported by New Mexico and Montana.

In view of these facts it appears that the practical cattleman would make fewer mistakes, due to environmental conditions, in selecting and culling beef cattle if he will keep the following information on his beef herd.

1. Estimate of birth date (within ten days)
2. Shoulder-brand (or other) females with the year they are born.
3. Identify all breeding females by horn brand, neck chain or other identification

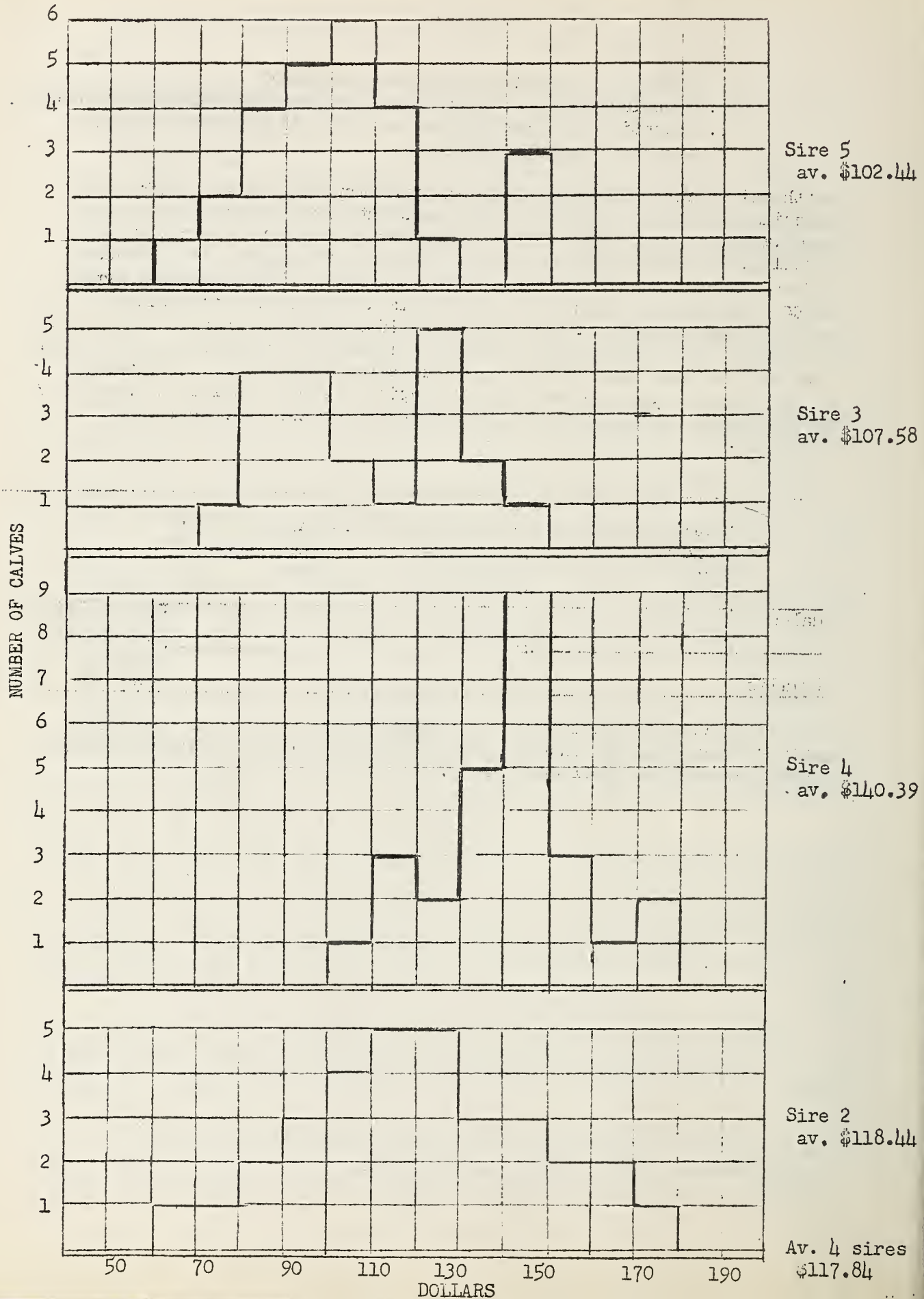
With this information at hand, then with very little extra effort at weaning time he can separate the calves into small groups that are of similar age, sex and from dams of similar age. If six corrals were available he could first sort out all calves within four or six weeks of the same age into their respective age groups. Then each age group might be dispersed among the six corrals as to sex and according to what age their dam was. The result would be that the rancher would have, in each corral, calves with similar environmental conditions and he could then walk or ride into the corral and compare one calf to the others in that corral, keeping the larger, typier, bloomier calves as possible replacements. He could then reject the others and cull their dams from the herd.

	Calves out of 3- and 4-year old dams	Calves out of 5, 6, and 7 year-old dams	Calves out of 8 and 9 year-old dams	
Males				Calves within four or six weeks of the same age
Females				

This is essentially what our indexes do and it appears that this manner of applying an index in the field should result in fewer mistakes caused by environmental conditions.

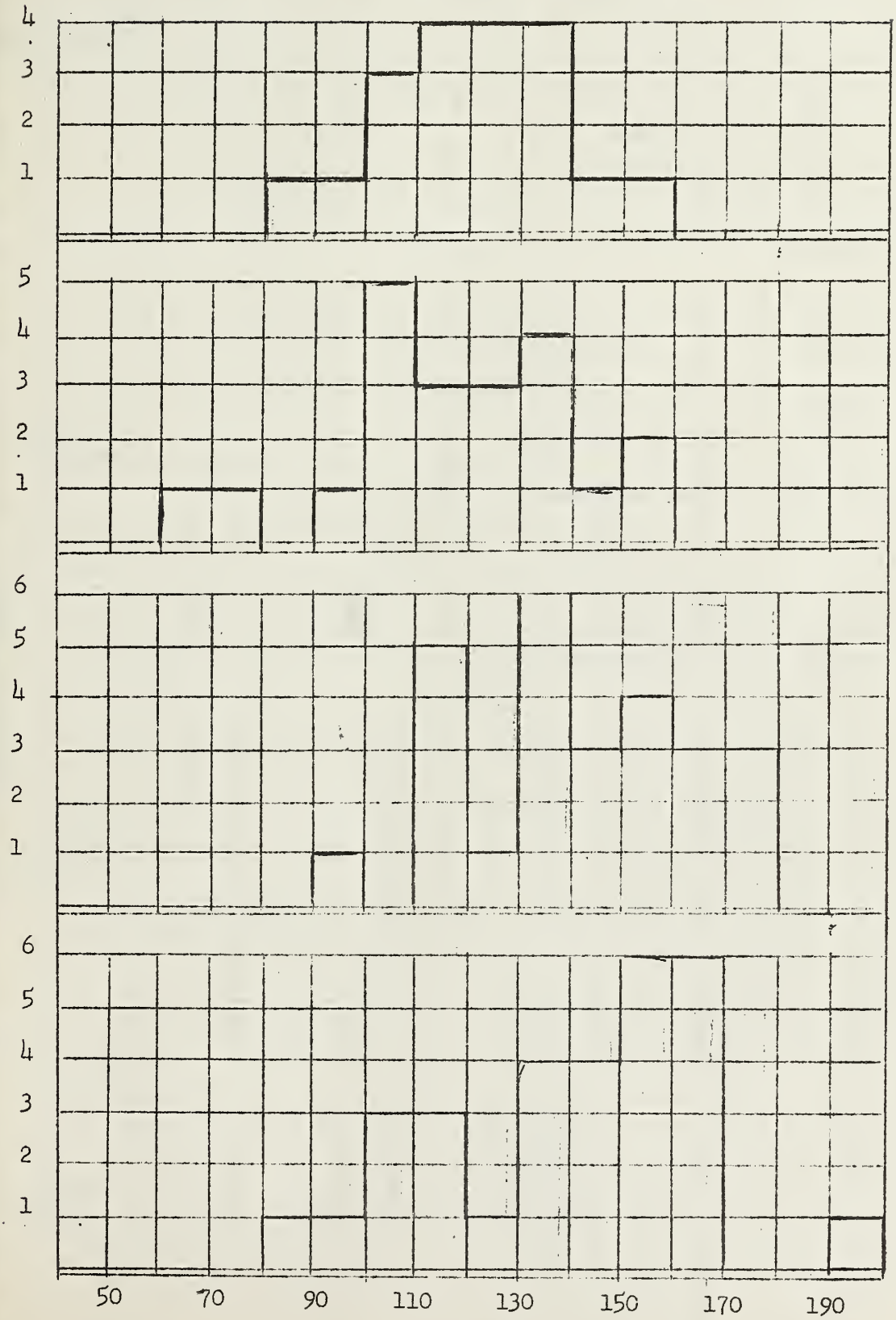
Graph 1

Estimated dollar value of calves produced by sires. 1948



Graph 2

Estimated dollar values of calves produced by sires. 1949



Sire 5
av. $121.26

Sire 8
av. $117.53

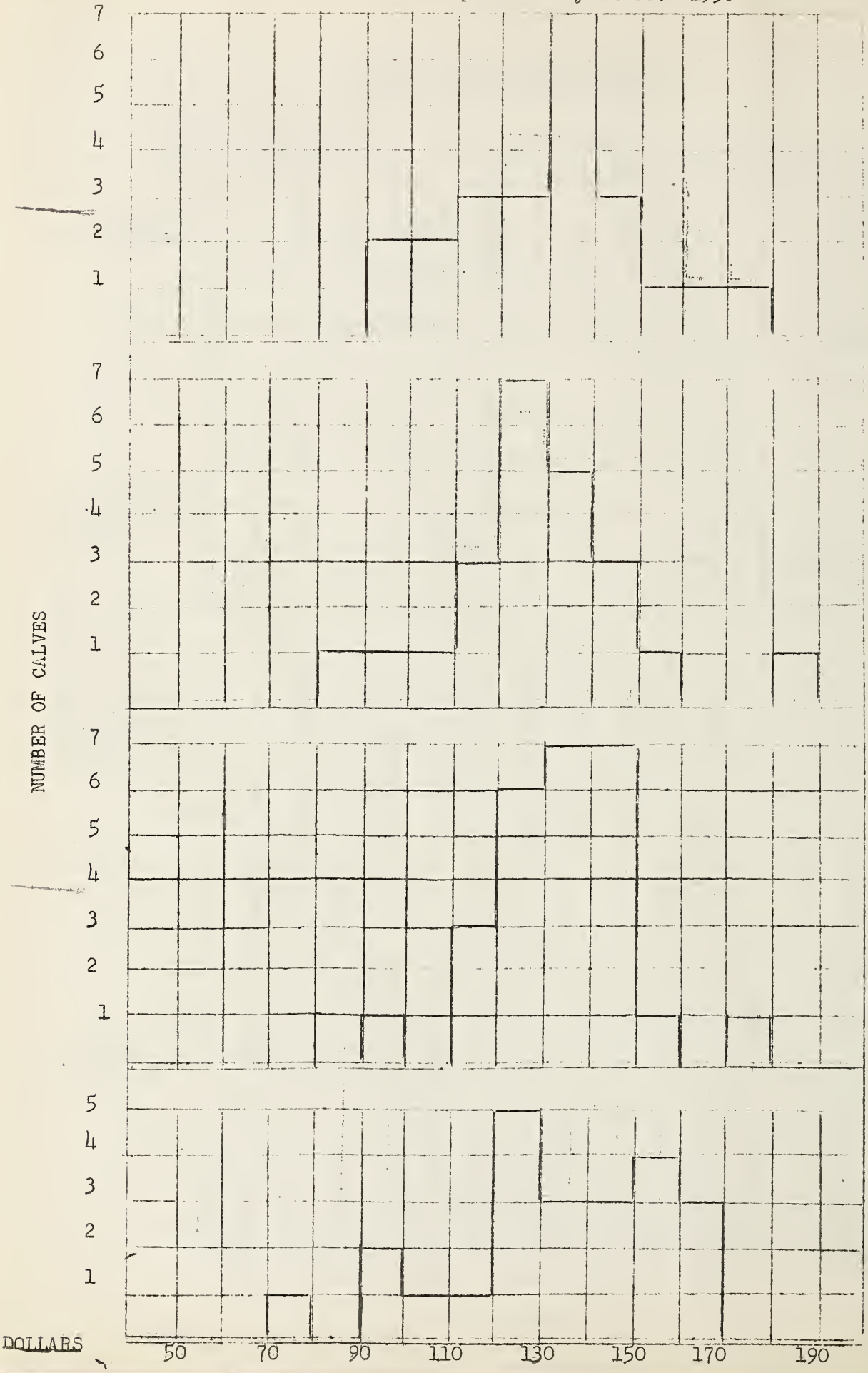
Sire 4
av. $140.71

Sire 11
av. $139.77

Av. 4 sires, $131.26

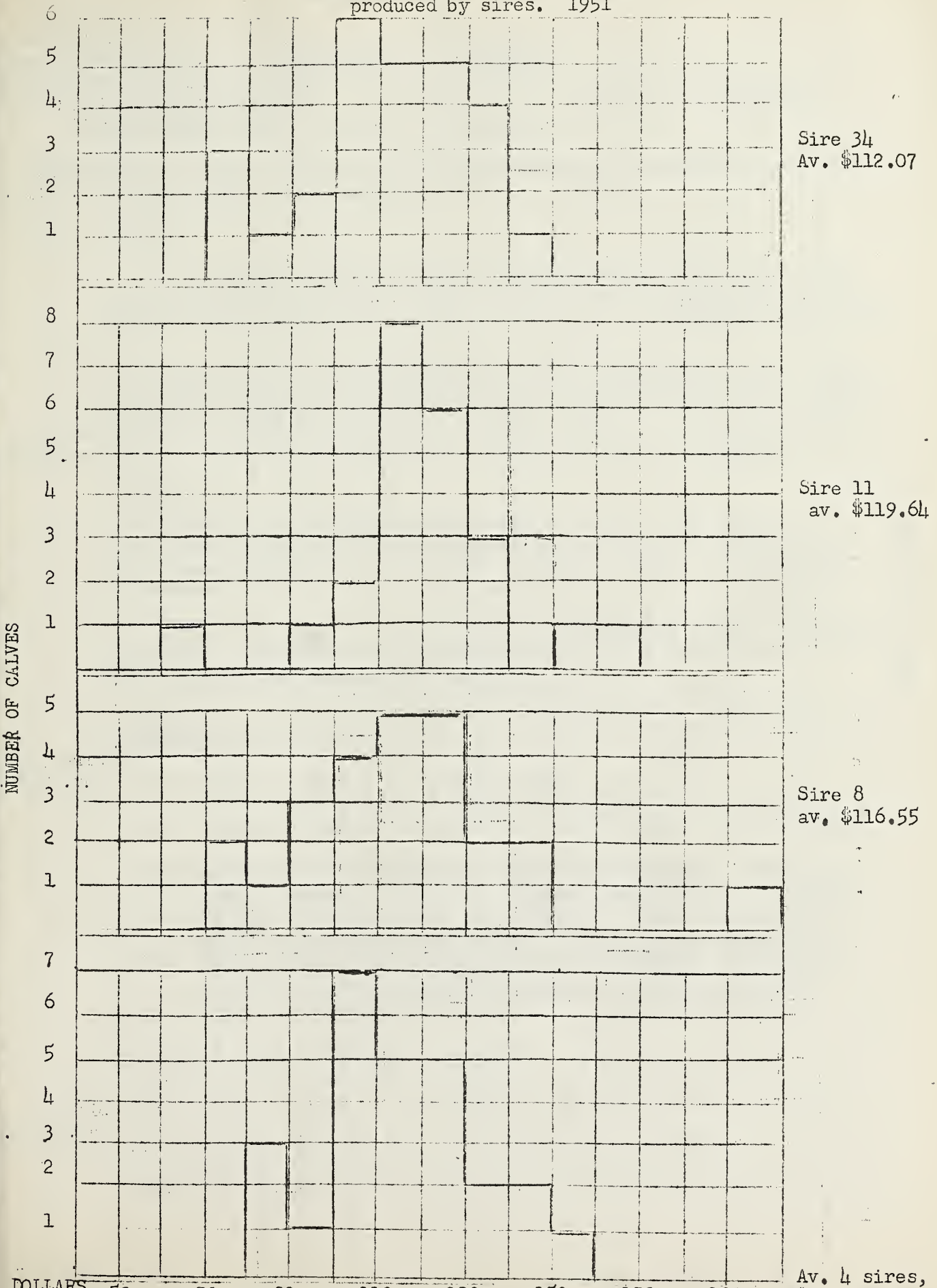
Graph 3

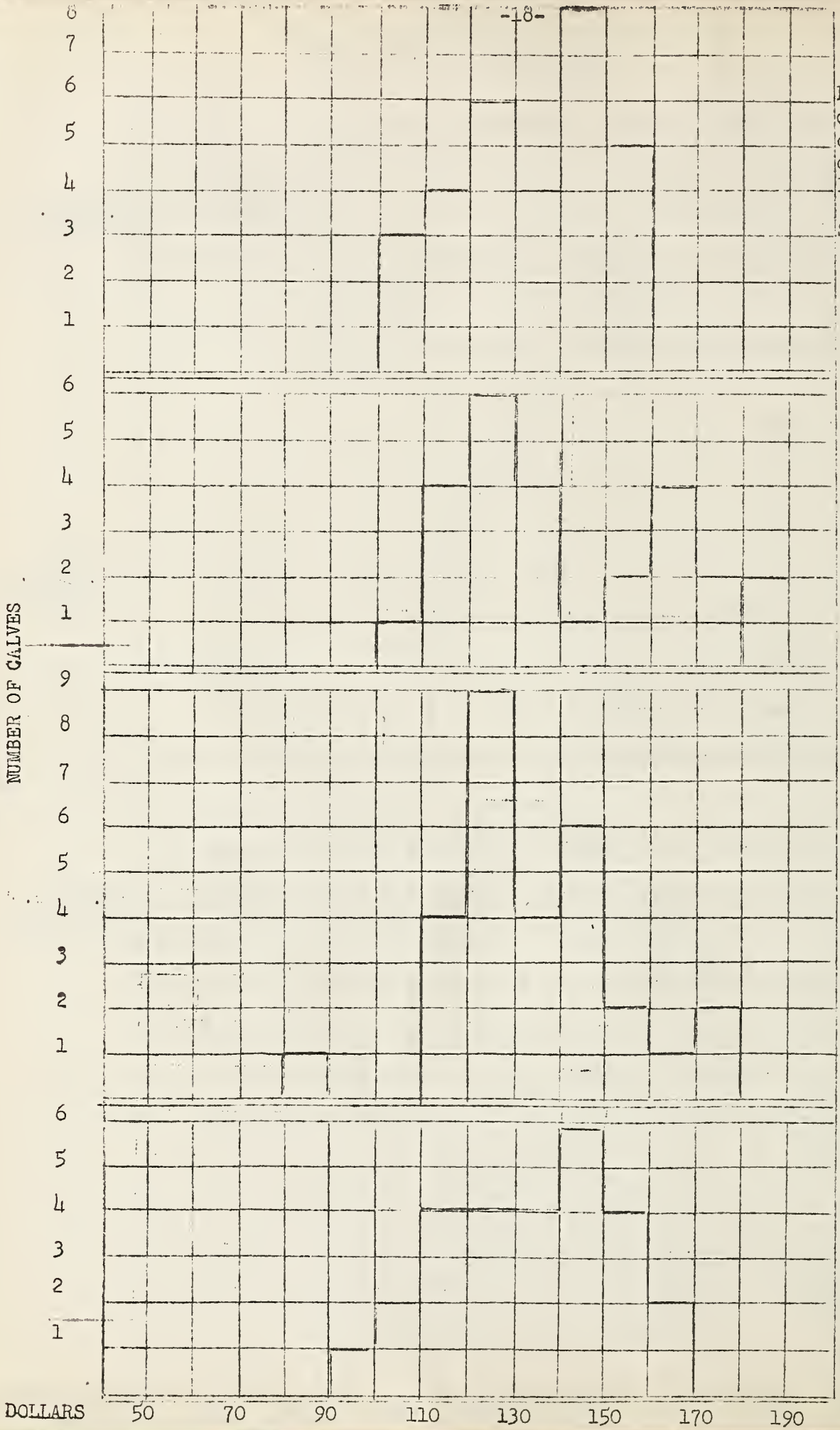
Estimated dollar value of calves produced by sires. 1950



Graph 4

Estimated dollar value of calves produced by sires. 1951





Graph 5
Estimated dollar value of calves produced by sires. 1952

University of California

I. Technical Personnel: P. W. Gregory, F. D. Carroll, G. P. Lofgreen, Mary Stine, James B. Burgess, Don Toenjes.

II. Title: Genetic Control of Hereditary Deficiencies in Beef Cattle with Special Emphasis on Dwarfism.

III. Object:

1. The identification of potential dwarf producers from specific body measurements obtained from dwarfs, heterozygotes and homozygous normal animals. Critical data are being collected in the field from many herds.

2. Obtain critical data from sons and daughters, from two to twenty-four months of age, of proven homozygous and heterozygous sires. Check evidence for segregation and nature of segregation in the progeny of each sire. Added to this can be progeny tests of all bulls and heifers that go into herds that can provide progeny tests for a definite proving.

3. Correlate juvenile body measurements with mature phenotypic expressions of dwarfism. Measurements at one to two months of age, three months, weaning, twelve months, eighteen months, and later if necessary.

4. Complete analysis of hereditary and environmental factors affecting head form. Include study of identical twins. Data from 2. and 3. above can also be used in this analysis.

5. Comparison of heterozygous with homozygous normal. Data from slaughtered animals.

   a. Study comparative anatomy of head.

   b. Correlate anatomy of head more closely with the head contours.

   c. Check endocrine responses of the two genotypes. (The thyrotropic hormone of the heterozygote should show less response and thus agree with the head contour. This will also give a check on penetrance and expressivity in the heterozygote.) These data are to be collected in the field in collaboration with the USDA Beef Breeding Program. The assays will be made in our laboratory.

6. Comparison of endocrines of dwarfs.

   a. Bulls.

   b. Steers.

   c. Heifers.

7. Metabolism, feed utilization and slaughter tests of homozygous and heterozygous animals. (Animals especially produced for this study.)

a. Compare metabolism.

b. Compare efficiency of feed utilization.

c. Compare slaughter grades, dressing percent, percentage cuts of carcass, etc.

d. Compare endocrines of the two genotypes.

If heterozygotes have a slightly lower basal metabolism (than homozygous normals), with other things equal they may use feed more efficiently and may have other characteristics that would be desirable or economical in beef production. Thus, the dwarf gene in the heterozygous state may actually enhance beef production. If this should prove to be true, the gene could be used to advantage by commercial cattlemen if losses from recessive dwarfs can be eliminated.

8. Allometric study of dwarfs. This study may lead to the development of new diagnostic characters for identifying heterozygotes and homozygous normals.

9. Identify the different genes that condition dwarfism in all the beef breeds. (Tests are now under way).

10. Gene-frequency analyses in all the breeds involved.

11. Explore the possibility of using mutant dwarf stocks of laboratory animals (rats, mice, rabbits, chickens, etc.) as assay material for identifying specific endocrine deficiencies that may be present in the various dwarf types of cattle.

12. Exploit any pertinent problems that may arise as a result of these investigations.

13. Now that dwarf carrier and dwarf free mature bulls can be identified with a degree of accuracy 90 percent or higher, plans are underway to apply the profilometer technique to breeders in the field that want this service. The implementation of such a program was discussed by Experiment Station and Extension Personnel of the eleven western states and Texas at a conference in Denver last June 8 and 9.

IV. Work Progress and Results:

Throughout this study the major difficulty was to obtain a sufficient number of animals of proven genotype to test promising working hypotheses. Difficulties were encountered in locating bulls that were proven dwarf free at reliable probability levels. Most breeders lack an appreciation of the requirements that must be met for an adequate progeny test and thus most of the bulls found that were alleged to be dwarf free were proven

below the 10 percent level. Often the progeny test that a breeder assumed to prove a bull to be dwarf free was invalid because stillbirths or calves that died early were not classified with respect to dwarfism. Furthermore, breeders often attempt to prove bulls by mating them to daughters of dwarf carrier animals. This test is valid provided that unselected daughters are used. Several progeny tests were encountered in which the breeder had many daughters (an appreciable percentage of which were proven to be heterozygous for dwarfism) and he attempted to prove several bulls simultaneously. If he uses the proven heterozygous cows for direct tests, then the unproven half sisters are of questionable value in proving other sires, since the 1 : 1 ratio of heterozygous and homozygous normal genotypes may be seriously disrupted.

To date profiles have been obtained from over 80 bulls that are considered to be free from the dwarf gene. Of these the status of individual progeny tests on about 35 are sufficient to state the probability of homozygosity at an adequate level, many at the 1 percent and none under the 10 percent level. The remaining bulls assumed to be dwarf free are from breeding that is proven to have a low frequency of the dwarf gene, in addition to the fact that each individual bull is partially proven but below the 10 percent level. The probability that any of these bulls may prove dwarf carriers is extremely remote. With these data from animals of known genotype it has been possible to check the expression of the dwarf gene in the heterozygous state.

Studies this year have evaluated the effect of age, different profilometers of standard design, and different operators upon the value of the different characteristics used in differentiating the two genotypes from the head profile. None of the effects of these variables are of sufficient magnitude to greatly affect the differentiation of the genotype involved if the profiles are taken in the recommended manner which is regarded as standard.

Five percent of the herd bulls sampled have a type of head in which there is no dish in the face and the nasal frontal juncture is high. This is a relatively rare type of head (Type I), and there is an insufficient number of these animals that have been progeny tested to subdivide this group into dwarf carrier and dwarf free genotypes. Thus at present prediction of genotype is made on only approximately 95 percent of the population--those that do not have Type I heads.

In the preceding annual report it was emphasized that dwarf carrier and dwarf free nature bulls could be differentiated with a high degree of accuracy from the vertical relationship of three diagnostic points of the nasal frontal juncture (NFJ), midforehead point (MFP) and the parietal frontal juncture (PFJ) on the profile. This method of differentiation was effective but cumbersome. Since then the possibility of developing discriminant functions for differentiating dwarf carrier and dwarf free bulls have been explored. Several different discriminant functions were developed that separated the two genotypes into bimodal distributions with only slight overlapping zones. The distribution of heterozygous and homozygous normals when one of the discriminant functions is applied is shown in figure 1. This is a distinct bimodal distribution with the

Known Genotype
When Profiled

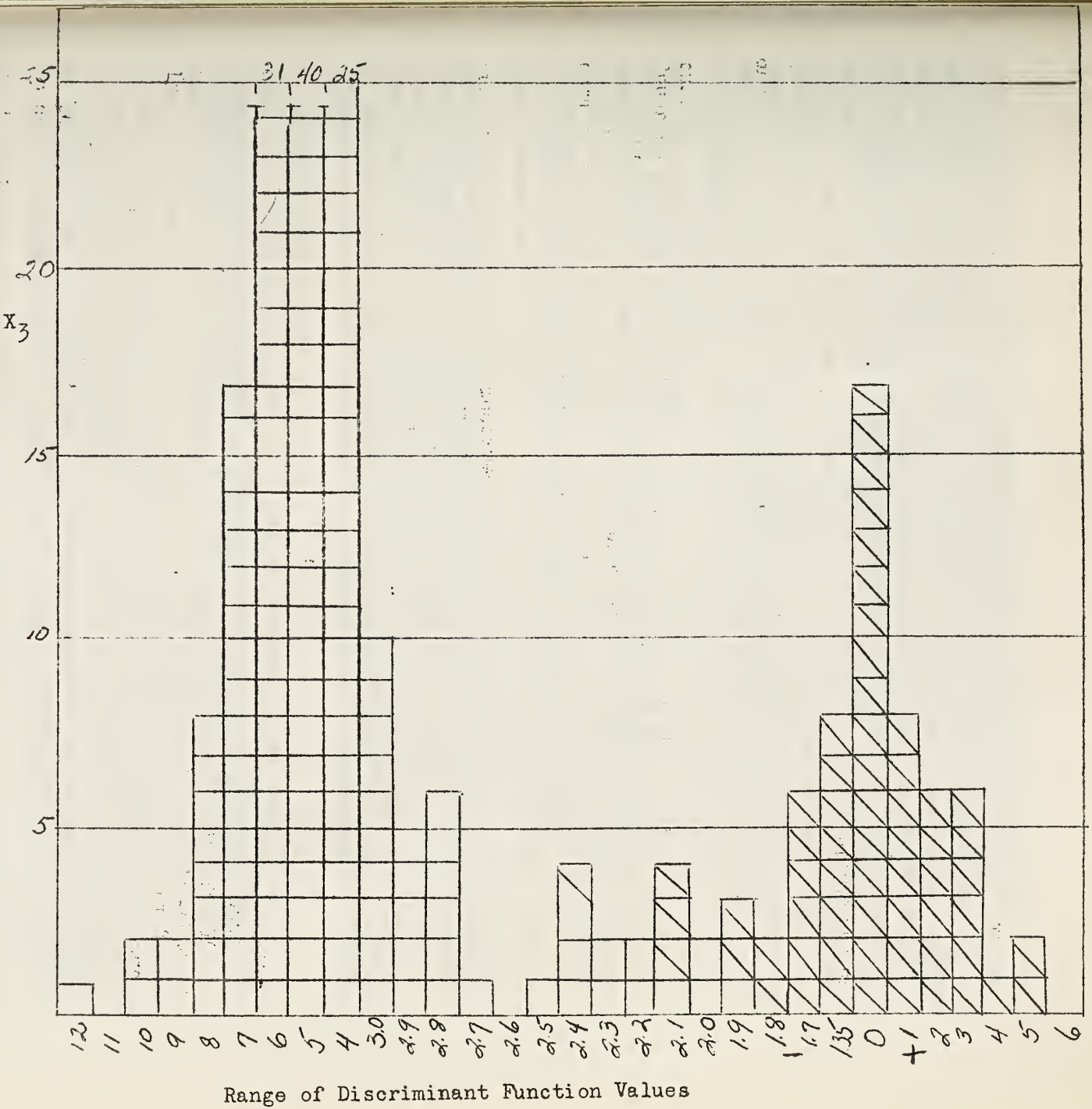
X_1 - NFP - NFJ

X_2 - MFP - PFJ

X_3 - PFJ - NFJ

Formula

$-1.77 \cdot X_1 \neq X_2 \neq 1.3 \cdot X_3$



Heterozygous
Key and check

Homozygous
Key and check

majority of heterozygotes and homozygotes well separated but with a slight overlapping zone. Some of the contributing causes for the overlapping are known. The evidence is that in bulls the dwarf gene in the heterozygous state has expression in all animals, but certain basic head shapes coupled with specific types of the frontal suture may mask the expression of the dwarf gene in the median profile of some heads. It is possible that refinements now in progress may completely separate the two populations. These results have been checked by other critical field tests. One test involved several herds that were using bulls from the same source. These herds were having occasional dwarfs. All of the herd bulls were profiled and measured without the investigators knowing the genotype of a single bull. The three standard discriminant functions were calculated for all the bulls and each discriminant function divided the bulls into bimodal distributions which coincided with the distributions of animals of known genotype.

Figure 2 shows the distribution when Discriminant Function 2 is applied. It was assumed that the animals at the left were heterozygous and those at the right were homozygous. After the discriminant functions were calculated and the results plotted, the breeders then provided the identity of the animals that had sired dwarfs and they are indicated by d. Complete analyses of the breeding records of these herds were made to determine if any of the fortuitous matings would definitely prove the genotype of additional bulls. There was evidence that one animal suspected of being a carrier and three others were heterozygous (these are indicated by d'). Progeny tests of nine animals that plotted as homozygotes indicated that they were actually homozygous (indicated by ^{D}); a tenth bull produced 55 normal progeny and no dwarfs from test matings, however there were 10 additional calves, 5 stillborn and 5 that died before one month of age. Since it is assumed that these were not adequately classified with respect to dwarfism the sire is considered unproven. This test is in complete agreement with all the earlier observations.

The second test served two purposes; (1) it was used as a check for the key or discriminant functions for differentiating genotypes and, (2) it was used to determine if it was feasible for a trained operator to take profiles in the field and if trained personnel in a central laboratory could differentiate the heterozygous and homozygous sires from the head profile and head measurements taken by the first operator.

In all of these tests the genotype of the sire was withheld until after the prediction of genotype was made. In most cases the animal was identified by tattoo or a code number. Predictions of genotype were made on many more animals than are indicated. Only those that have progeny tests or are alleged to be proven are shown in Table 1. The operators are indicated by number. Some had less than thirty minutes instruction before taking the profiles. The limited number of profiles taken by five different operators are combined in 5. The first field test was actually made by operator 3. It should be noted that all the errors are of heterozygous bulls that are assumed to be dwarf free. One of these exceptional animals is known to be "bilobed." It is suspected that all of the exceptionals are bilobed. Since the bilobed type is now clearly recognized it is assumed that fewer errors will be made on them in the future. The bilobed type is found in 2 to 3 percent of mature bulls. These results show that dwarf free and dwarf carrier bulls can be consistently identified from the median profile with a high degree of accuracy.

MATURE BULLS OF UNKNOWN GENOTYPE WHEN PROFILED

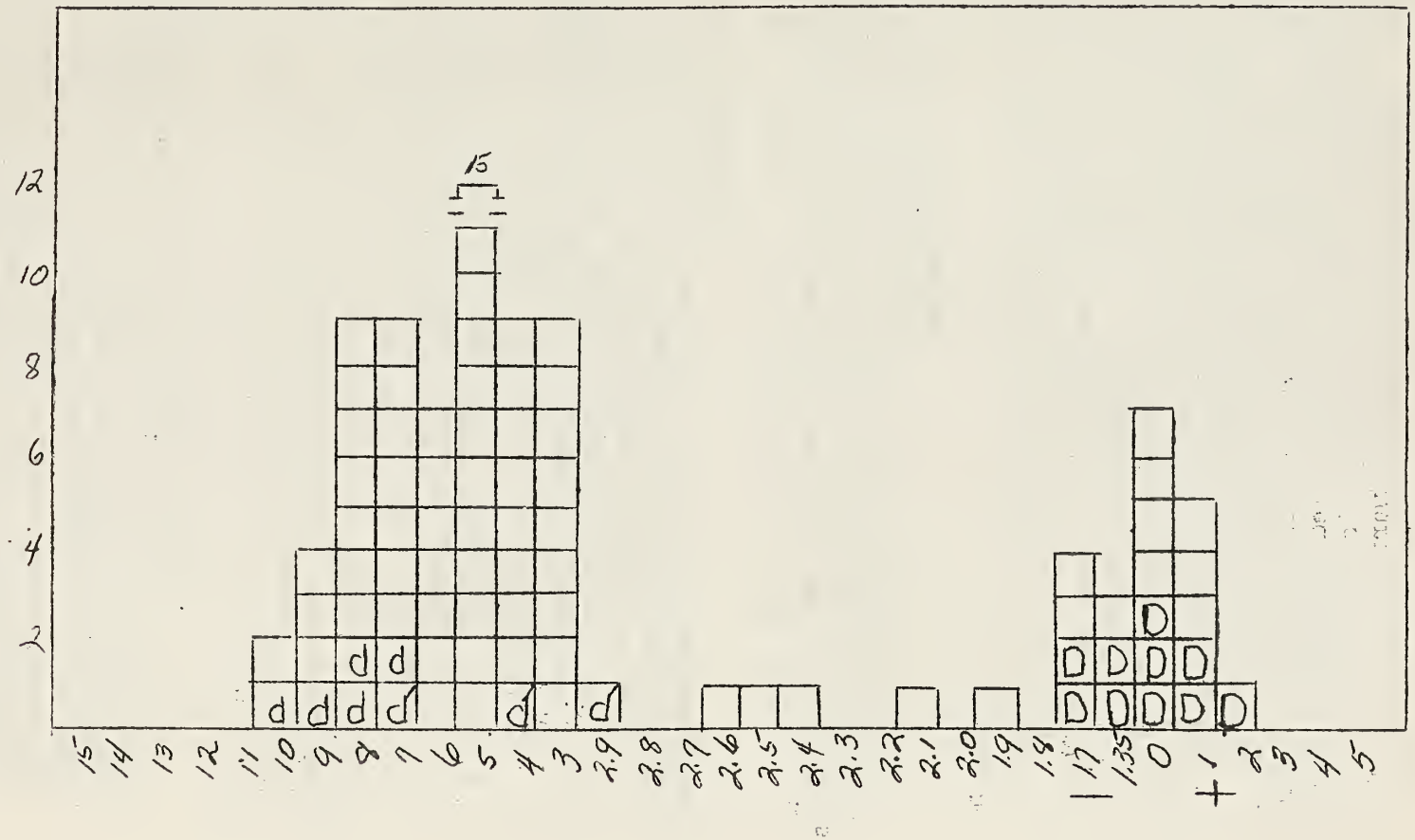
D. F. 2

X_1 = MPF - NFJ

X_2 = MFP = PFJ

X_3 = PFJ - NFJ

D.F. = $-1.77 \cdot X_1 \neq X_2 \neq 1.3 \cdot X_3$



FIELD TEST OF BULLS PROVEN BY PROGENY TESTS

Operator	Predictions of Genotype from Profiles		Results of Progeny Tests		Errors	Undetermined
	Carrier	Dwarf free	Carrier	Dwarf Free		
1	20	2	21	1	1	0
2	25	1	25	1	1	2[a]
3	6	1[b]	7	0	1[b]	1
4	43	0	43	0	0	0
5	22	0	22	0	0	1[a]
6	31	6	32	5	1	0
7	11	1	12	0	1	0
8	59	16	60	15	1[c]	1[d]
Total	217	27	222	22	6	5

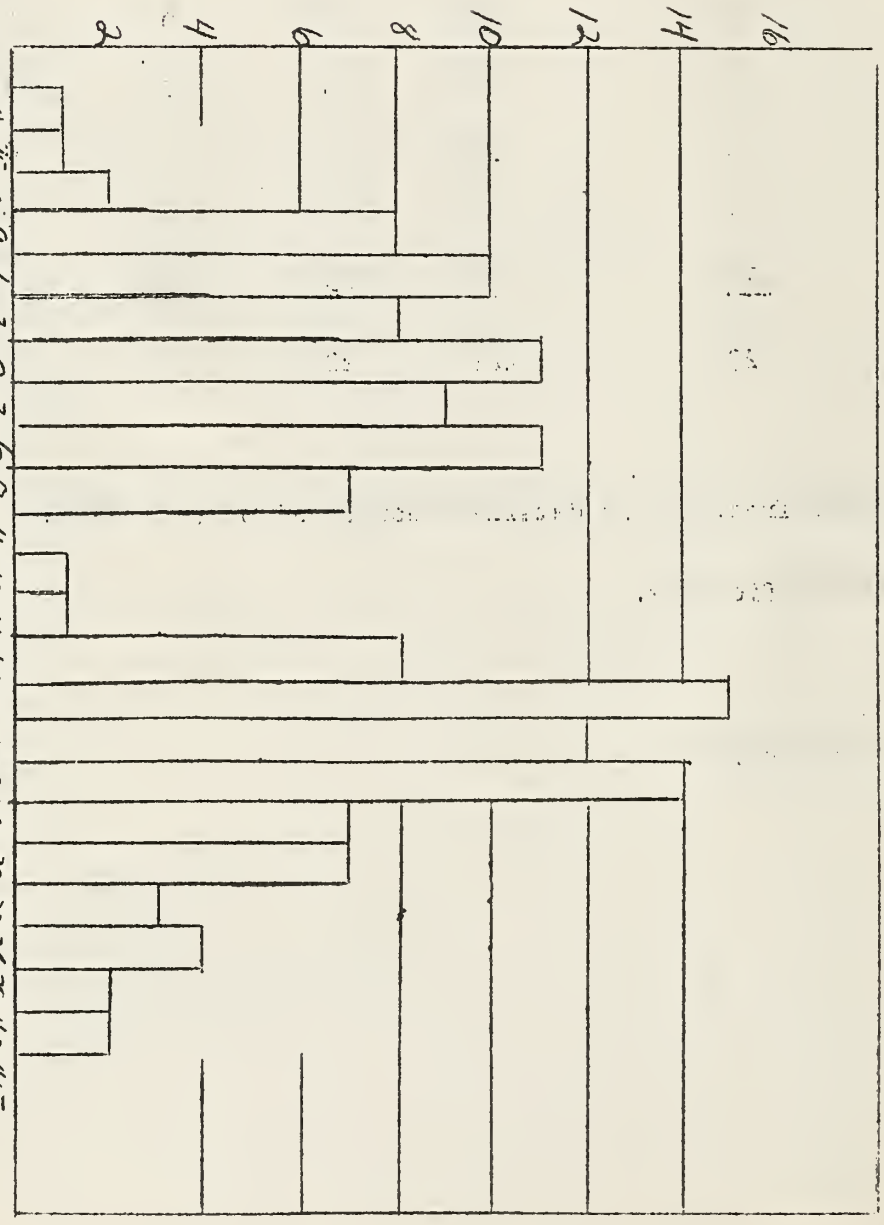
[a] Alleged dwarf free, but no detailed results of progeny tests.

[b] Not reported officially.

[c] Bilobed.

[d] Progeny test invalid.

The distribution of bulls 12 to 17 months of age in which there should be heterozygous and homozygous normals when the C discriminant function is applied.



The recognition of the two genotypes at early ages is of utmost importance to breeders. This is being investigated in younger animals. The three discriminant functions calculated for mature bulls were applied to several samples of bulls in which there should be both heterozygous and homozygous normals. Each of these functions divided all the populations into bimodal groups. It was suspected that different constants might be more appropriate for separating the two genotypes in younger animals. This possibility was explored and three new discriminant functions were developed for bulls from 12 to 17 months of age. All three are more effective in separating animals of this age range into distinct groups. The distribution of a group of young bulls when the C function is applied is shown in Figure 3. Many bulls were profiled two or three years ago at 10 to 17 months of age and were later profiled at maturity, thus giving an indirect check on the genotype. Furthermore the genotype with respect to dwarfism of a few of these bulls have been proven by progeny tests. It is evident from those two sources of data that the group from -18 to 11 are homozygous or are predominantly so, and the group from 13 to 42 are heterozygous or are predominantly so.

By using similar techniques on bulls from 4 to six months of age there is evidence that an appreciable percentage of the two genotypes can be separated at this still younger age. More data are needed to explore the full possibilities of differentiating at this age.

Several hybrids between morphologically different dwarfs have been produced. Some of them are now of breeding age and tests designed to disclose the relationship between the morphologically different dwarf types are under way.

In the cooperative effort on the analysis of the dwarf data, profiles on approximately 160 heterozygous cows and profiles from a number of unproven control cows were made available to Dr. Stratton of the Wyoming Station who will report the progress on females. The success of this research is attributed to the cooperative efforts of breeders, Experiment Station personnel of several Stations, and the Bureau of Animal Industry, Animal Husbandry Division, Beef Cattle Research of the Denver office. Special mention should be made of two Stations because of the importance of their contributions. The New Mexico Station herd provided data on several animals that were proven by progeny tests. These were of extreme value in developing the discriminant functions and checking their efficacy. The Arizona Station also provided data that was of strategic value in developing the discriminant functions. Additional Cooperation is planned with these Stations that will be sufficient to serve the best interests of each group of investigators involved and the overall program. The cooperation with the Wyoming Station was mentioned above. The Denver office of Beef Cattle Research has been of inestimable value in aiding the program in many ways.

V. Animal Inventory - Experimental Dwarf Herd:

	Herd Bulls	Cows	Yearling Heifers	Yearling Bulls
Hereford (Dwarf)	1	8	0	0
Hereford (Heterozygous for Dwarfism)	1	15	3	3
Angus (Dwarf)	1	4	0	0
Shorthorn (Dwarf)	1	3	0	0
Hybrids from Dwarfs (Hereford-Angus)	1	0	1	1
Hybrids from Dwarfs (Hereford-Shorthorn)	0	1	0	0

VI. Animal Inventory - University of California - Experiment Station Herds:

	Herd Bulls	Cows	Yearling Heifers	Yearling Bulls	Heifer Calves
Hereford (Davis Station)	8	39	11	16	17
Angus (Davis Station)	4	10	3	5	2
Hereford (San Joaquin Exp. Range)	0	139	53	95	
Hereford (Imperial Valley Station)	1	1	20	1	
Brahman (Imperial Valley Station)	0	0	2	1	
Bradford (Imperial Valley Station)	0	6	22	6	
Brown Swiss (Imperial Valley Station)	0	8	4	1	

VII. Facilities:

Davis: 50 acres of hay and pasture; corrals, barn space, scales, etc. Research laboratories for genetics, physiology, biochemistry and anatomy.

VIII.

Manuscripts:

Carroll, F. D., and P. W. Gregory and W. C. Rollins, Thyrotropic Hormone Deficiency in Homozygous Dwarf Beef Cattle. Journal of Animal Science, 10:916-921. 1951

Gregory, P. W., W. C. Rollins, P. S. Pattengale and F. D. Carroll. A Phenotypic Expression of Homozygous Dwarfism in Beef Cattle. Journal of Animal Science. 10:922-933. 1951.

Gregory, P. W., S. W. Mead, W. M. Regan and W. C. Rollins. Further Studies Regarding Sex-Limited Genetic Infertility in Cattle. Journal of Dairy Science. 34:1047-1055. 1951.

Gregory, P. W., S. W. Mead and W. M. Regan. A Genetic Analysis of Prolonged Gestation in Cattle. Portugaliae Acta Biologica Series - R. B. Boldschmidt. Volume 861-882. 1951.

Gregory, P. W., W. C. Rollins and F. D. Carroll, 1952. Heterozygous Expression of the Dwarf Gene in Beef Cattle. Southwestern Veterinarian, V, (4) 345-349.

Gregory, P. W., and B. B. Brown, 1952. A Profilometer for Studying Head Form of the Bovine. Journal of Animal Science. 11: (4). 1952.

Gregory, P. W., F. D. Carroll, C. B. Roubicek, P. O. Stratton, N. W. Hilston. 1953. Inheritance of Dwarfism in Herefords and the Detection of Heterozygotes. Hilgardia, (in press).

Ware, W. S., 1952. Evidence for the Expression of the Dwarf Gene in Heterozygous Bulls. University of California, Doctors thesis.

University of California

Addenda

There has been considerable publicity in which it has been alleged that the profilometer technique consistently failed to discriminate between heterozygous and homozygous normal bulls. This percentage of failure was asserted to be considerably higher than that observed on animals of proven genotype assembled in the pooled data. These exceptions are alleged to have occurred in a private herd and in the experimental herd at the Fort Lewis substation. All of these animals were first profiled by Dr. Roubicek and definite carrier type profiles were found in both herds.

A careful check of the privately owned herd by Dr. Stratton and later by Stratton, Roubicek and Gregory, revealed that some of the bulls had definite carrier type profiles. A check of blood types of one atypical bull along with his sire and dam revealed that this atypical bull could not have been the son of the sire under which he was registered. Thus the status of this herd must be left open for the present.

Several of the sires of the Fort Lewis herd that Dr. Roubicek profiled were of the carrier type and Professor Stonaker claimed that there was no dwarfism in any of the inbred lines, and that this herd unquestionably invalidated the profilometer technique for differentiating between heterozygous and homozygous normal bulls with respect to the dwarf gene. He invited Dr. R. T. Clark, C. P. Stroble, and Gregory to profile the Ft. Lewis herd bulls that Dr. Roubicek had profiled earlier, and also the yearling bulls. This was done on May 5, 1953, by the three named above in company with Professor Stonaker. The discriminant functions on the herd bulls are appended for the profiles taken by Roubicek in December of 1952 along with the profiles taken by Gregory. The status of all the bulls are substantially the same for both profiles as the tabulated data attest.

Two dwarf calves were observed in the herd. Both obviously belonged to comprest cows, however the identity of the sires of these calves was not obtained. Professor Stonaker called both of these calves comprest dwarfs but one was certainly in the phenotypic range of the dwarf type with which California Station is concerned. The other dwarf was more severely afflicted but it was not atypical for the type of dwarf that is causing the most concern. Unless some of the herd bulls were comprest the comprest dwarf characterized by crooked legs would not segregate out. However the two typical recessive dwarf genes combined with a comprest gene is a possibility. This could account for the extreme expression in the second dwarf.

Professor Stonaker later showed us a calf which he called hydrocephalus that died some weeks before, and that had been preserved by freezing. This calf manifested the bulging forehead and disproportion between the upper and lower jaws, the characteristics typical of dwarfs. The head was removed and brought to Fort Collins for autopsy. Professor Stonaker agreed to send us a complete report. He steadfastly maintained that this was a hydrocephalus calf and not a true dwarf. When his report was submitted, it omitted the specific statement in the

official autopsy report that this calf was a typical dwarf. Copies of Professor Stonaker's letter covering the results of the autopsy and the official autopsy report are appended.

Two other dwarf calves were sired at the Akron Station by bulls from the Real Prince line bred at the Fort Lewis Station. Two half brothers by the same sire were bred to a group of cows and two dwarf calves were produced. This indicates that one or both of these bulls were heterozygous for dwarfism.

The skulls of these two dwarfs are in the California dwarf collection and Professor Julian, Anatomist of the School of Veterinary Medicine, will make a detailed comparison of them with the extensive dwarf material of known genotype that has been and is being assembled.

The information in our hands on the Fort Lewis herd may be summarized as follows:

1. Dwarfs have occurred in several of the inbred lines at Fort Lewis and there are valid reasons to believe that conventional dwarfs have occurred in both the Prospector and Real Prince lines, also in matings of comprest x comprest.

2. Two types of dwarfs are assumed to be occurring; (a) the "crooked leg" type caused by two comprest genes; and (b) the common type of dwarf that is causing so much concern throughout the country.

3. Apparently Professor Stonaker has made no distinction between these two dwarf types and the situation is further confused by the possibility of the typical recessive type of dwarf (the one causing great concern) being combined with one comprest gene. It is possible that if adequate records of all dwarf types were recorded in the Fort Lewis herd, many important questions concerning the genetic relations and interactions between the comprest dwarf gene and the conventional type of dwarf gene might be answered.

4. The Fort Lewis herd does not invalidate the profilometer technique as a successful means for differentiating between dwarf carrier and dwarf free bulls; on the contrary it supports the profilometer technique as a diagnostic means of differentiating the two genotypes.

5. It is hoped that at the Laramie meeting it will be possible to have a completely frank discussion which will reveal the exact situation in the Fort Lewis inbred lines.

C
O
P
Y

COLORADO AGRICULTURAL AND MECHANICAL COLLEGE

Fort Collins, Colorado

June 4, 1953

Dr. Carl Roubicek
Bureau of Animal Industry
310 New Customhouse
Denver 2, Colorado

Dear Dr. Roubicek:

The pedigree of calf 3032 is enclosed. The diagnosis reads as follows: Slightly enlarged frontal bones; some hydrocephalus of the brain.

The calf was born March 27, 1953 and lived about three weeks. The height measurement at birth was 24½ inches which is approximately three inches taller than the average dwarf and within the range of what we classify as normal type cattle. The calf died apparently of a prolapse of the rectum. Until this condition occurred, the calf appeared to be healthy. I hope this provides the information you requested.

Sincerely yours,

H. H.Stonaker, Professor
Department of Animal Husbandry

HHS:jn
enclosure

Pathological Record COLORADO A & M COLLEGE - VETERINARY MEDICINE No. 53P472

Species: Bovine Breed: Polled hereford Age: 3 weeks Sex: May 12, 1953
Height: inches. Weight: Hrs. since death: by: Dr. Griner
Owner: Colorado A & M, AH #3032 Hospital No.
Clinical History and diagnosis: skull characteristic of dwarfism, small prolapse of rectum.
Skin & external: slightly enlarged frontal bones.

Mouth:
Nasal Cavity:
Trachea
Esophagus
Pharynx
Larynx

Thyroid gms. x x cm.
Thymus

Heart gms. x x cm.

Pericardium

Lungs

Pleura
Thoracic lymph nodes
Peritoneum & cavity

Liver gms. x x cm.
Gall bladder
Spleen gms. x x cm.

Stomachs

Intestines, small
Intestines, large

L. Kidney gms. x x cm.
R. Kidney gms. x x cm.

Adrenals
Pancreas
Lymph nodes

Bladder
Ureters
L. Ovary - Testis
R. Ovary - Testis
Uterus - prostate
Cervix
Bones & joints

Brain: some hydrocephalus

Postmortem diagnosis:

REPLY TO UNIVERSITY OF CALIFORNIA
ADDENDA TO 1953 W-1 REPORT

It was requested by Dr. Roubicek that I prepare a reply to the addenda of the University of California Report. It is as follows:

Paragraph 3: Genetic Predictions on twelve bulls were the same in December as in May for seven out of twelve bulls. The discriminant functions for the December and May profiles on the bulls are to be presented in the minutes.

Paragraph 4: It has been publicly announced at previous Fort Lewis Field Days, and at any occasion at which the subject was raised that a large number of dwarfs has been obtained from the mating of comprest bulls to the comprest cows. There is also an inbred line being developed from the Comprest cattle now called the Mesa line. In this line there have been dwarf calves as has been known to anyone who has been associated with the herd or the work of the Colorado Experiment Station including Drs. Sierk, Roubicek, Clark, and Gregory. The two dwarf calves shown to Drs. Clark and Gregory out of comprest cows were sired by the comprest bull Hiwan Prince C-58. It is impossible for me or, I think, anyone else to say with any experimental basis whether these are due to the action of the comprest gene, or the dwarf gene as found in normal cattle. It does seem, however, that most, but not all, of the dwarfs from comprest matings have exceedingly crooked front legs. The fact remains that according to our observations we have obtained dwarfs in the Fort Lewis herd only when comprest bulls have been mated with comprest cows. Dr. Gregory, I believe, agrees that the dwarfs obtained from matings of comprest bulls and comprest cows are very likely to be due to the action of genes that are different than the type of dwarfs occuring from mating normal or conventional types of cattle. If this were not the present assumption then comprest cows would be considered to be very useful as tester cows. Dr. Gregory and Dr. Roubicek have both stated that in their own study comprest animals were not included; thus, it seems to be reasonable to exclude the data on the comprest line in the Fort Lewis herd. Dr. Gregory, I believe, concurs with this decision and it has been one that has been steadfastly maintained throughout our discussions of the Ft. Lewis herd. As Dr. Gregory points out it is quite possible that in the comprest line two types of dwarfism may be occurring.

Paragraph 5: In order that Dr. Gregory would have an opportunity to evaluate calf #3032 I had instructed Mr. Riddle to freeze the animal. The calf apparently died of a prolapse of the rectum. The calf's birth measurements were 24½ inches at the withers; 25½ inches around the heart girth. These measurements fall within the range of normal cattle in the Fort Lewis herd and the wither height is considerably greater than that reported for dwarfs by the Utah station. The bulging forehead and disproportion between the upper and lower jaws are characteristics of dwarfs as reported by Dr. Gregory. However, the height measurement leads me to question this as undisputable evidence of dwarfism. The latter would tend to suggest that forms of hydrocephalus exist other than those associated with dwarfism. The official autopsy report has been miscontrued in the California addenda. The information on the veterinarian's report "prolapse" of the rectum and the skull characteristics of dwarfism" was presented to the veterinarian by myself and appear under the heading "Clinical History and Diagnosis". If there is any question of this being "Clinical History" as given by myself to Dr. Griner I would suggest that Dr. Griner be contacted. Copies of the official report were sent by myself to Dr. Roubicek as he requested.

The facts at Fort Lewis as I see them are:

1) Dwarfs have been obtained only from double comprest matings.
2) The 3032 calf from the Prospector line is questionable and was classified by Dr. Gregory on headshape alone as a dwarf; I have asked Dr. Hazel to check the calf's vertebrae.
3) The other lines at Ft. Lewis have not to our knowledge produced dwarf calves.

As in the past any questionable cases will be brought to the attention of people whom we consider qualified to judge them. If Dr. Gregory wishes it, we should be happy to save for him the skulls of all stillborn calves. If the Iowa station is willing, we should be happy to save the lumbar vertebrae of stillborn calves for their examination. If there is any research worker who wishes to examine the records or the calves we shall be only too happy to invite him to participate; and he shall have whatever information we have available at our disposal.

I should like to add that at Laramie, Professor Gregory was kind enough to let me review the addenda to his report and in view of my strong exception to the statements made in it he withdrew it from the report given at the Laramie meeting.

This reply was written at the verbal request of Dr. Roubicek.

/s/ H. H. Stonaker

H. H. Stonaker, Professor
Department of Animal Husbandry

August 25, 1953

HHS:os

W-1 ANNUAL REPORT FOR THE PERIOD JULY 1, 1952 to JUNE 30, 1953

Regional Beef Cattle Improvement Project
(not for publication)

I. Station - Colorado Agricultural Experiment Station

II. Title of Project - R & M 26, IMPROVEMENT OF BEEF CATTLE THROUGH BREEDING.-- A STUDY OF INBREEDING AND THE CROSSING OF INBRED LINES WITHIN THE HEREFORD BREED.

III. Facilities, Animals, and Personnel used in Project (with animal inventory shown by breeds, sexes, and age classes).

Personnel: H. H. Stonaker, Kent Riddle, F. C. Daugherty, two graduate assistants.

Animals See appendix

Facilities	Ft. Lewis	Colorado A & M
	6000 acres pastures, crossfenced	1500 acres pasture
	300 " hay land	sheds & lots for feeding
	12 lots for feeding and sorting	laboratories
	2 sheds for individual feeding	statistical lab.

IV. Studies in progress since last Annual Report

A. Profilometer Study

With the cooperation of the personnel of the University of California and the Bureau of Animal Industry, the herd bulls and line cows at Fort Lewis have been profiled in December of 1952 and May of 1953. The unculled 1952 calf crop was profiled in May and July of 1953.

1. Herd bulls

The genotypic predictions in December and May of the bulls two years old and over are presented in Table 1. The progeny record of the bulls is also shown in this and Table 2. The bulls were the herd sires in different inbred lines. The inbred matings were mostly with cows between 40% and 80% related to the bulls. Outcross matings result from the testing of daughters sired by bulls from other lines.

In Table 2 the numbers of alive & dead calves sired by bulls with different genotypic predictions are given. The comprest sire is omitted.

2. The distribution of head measurements for yearling bulls, yearling heifers, herd bulls, and cows in inbred lines are shown in Figure 1. Analysis of variance of these measurements and the covariance between the measurements of dams and of their progeny show the following:

	Intra Sire Progeny Dam Regressions	Paternal Half Sib Correlations	Significance of Differences Sexes	Sires
MFP-NFJ	.179	.055	**	NS
MFP-PFJ	.011	.235		
PFJ-NFJ	.135	.111	**	NS
Head Length	.368	.258	**	NS
Head Width	.023	.308	**	*
HL/HW	.171	0	*	NS

* = .05 level ** .01 level of significance.

While these regressions and correlations are not corrected for degree of relationship within breeding groups they may indicate relative heritabilities of the different measurements taken.

3. Tester Matings

Matings of three bulls from three different inbred lines which have carrier type profiles are being made with heterozygous cows and/or daughters of carrier bulls or carrier profile bulls in cooperator herds in order to test the genotypic predictions made from the profiles of these bulls.

B. Blood Typing Tests

a. Repeatability of tests. (In cooperation with Dr. L. C. Ferguson of the Ohio State University). In 19 cases of repeated tests on the same animals in different years 2 animals showed identically the same reaction to the reagents used in subsequent years. It would thus appear that in parentage tests blood samples of the progeny and possible parents should be typed simultaneously.

b. Disappearance of antigens in closed lines as the inbreeding rises. It appears that there may be opportunity to check empirically the rate of gene fixation by the rate of antigen loss in inbred lines. In the past 3 years 222 animals have been blood typed in seven inbred lines. The average number of antigens identified was 8.8 with a range of one to sixteen. The average inbreeding was 22.6% with a range of 2 to 47%. With each 10% increase in inbreeding a loss of 1.17 antigens has been found.

C. Field tests of inbred bulls

In December of 1952 on the Kenneth Conrad Ranch, Wray, Colorado, weaning weights were taken from 22 unselected calves out of two year old heifers and by 5 different bulls, including 2 inbred bulls from the Brae Arden and Colorado lines. The calves by inbred bulls weighed 393 pounds; those by outbred bulls 374 pounds. Other commercial cattlemen have field

tests in progress at present checking the first top cross progeny with the progeny of these purebred bulls.

Table 1. Genotypic predictions and progeny records of Ft. Lewis bulls.

Tattoo	Genotypic Prediction from Profiling Based on ("Southwest Veterinarian Key") Dec. 1952	May 1953		Inbreds No. Matings	No. Calves	No. Dead	No. Alive	Outbreds No. Matings	No. Calves	No. Dead	No. Alive
232	++	+d	1953	19	14	2	12	6	6	0	6
0144	+d	+d	1953	10	7	0	7	13	9	0	9
			1952	15	11	2	9	8	7	0	7
062	borderline	+d	1953	11	11	4	7	9	9	0	9
			1952	12	4	1	3	11	9	0	9
1238	+d	+d	1953	9	9	1	8	10	9	1	8
			1952	12	8	0	8	15	13	2	11
300	+d	+d	1953	4	4	2*	2	8	8	0	8
204	++	+d	1953	5	2	0	2	6	5	1	4
Comprest	+d		1953	15	10	0	10**	-		-	-
18			1952	7	3	0	3	14	9	0	9**
0180	++	+d	1952	5	4	1	3	8	5	0	5
292	++	++	1953	11	10	2	8	7	7	0	7
06	++	++	1953	8	5	0	5	7	6	0	6
28	(++)		1953	6	5	0	5	3	3	0	3
			1952	6	6	0	6	-	-	-	-
1205	++	I	1953	11	8	0	8	11	12	1	11
			1952	13	7	0	7	8	8	0	8
290	++	I		-		-	-	-		-	-
		All	1953	109	85	11	74(68%)	88	79	3	76(86%)
			1952	13	7	0	7(54%)	56	46	2	44(79%)

*One calf from profile defined as dwarf - 24.5" at withers at birth, died apparently of prolapse of rectum.

**Five dwarfs included from comprest x comprest matings.

(++) This bull is said by breeder to have sired dwarfs.

Yearling heifers are included in mating numbers although they may have been exposed less than a month.

Table 2. Summary of death losses of progeny of bulls with predicted genotypes.

	1952 Inbred Calves		Outbred Calves		1953 Inbred Calves		Outbred Calves		Total	
	Dead	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead	Alive
Dec. '52 prediction										
++	1	16	0	13	5	43	2	22	8	94
+d	2	17	2	18	3	17	1	25	8	77
May '53 prediction										
++					2	13	0	13	2	26
+d	4	23	2	32	10	41	2	49	18	145

Fig. 1. Distributions of Head Measurements - Ft. Lewis - 1952-1953

	Yearling Bulls	Yearling Heifers	Bulls 2 & over	Cows 2 & over
MFP -NFJ	-5,6 mm.			x
	-3,4 xx			
	-1,2 xx	x		xx
	0,1 xxxxxxxxxx	x	xxx	xxxxxx
	2,3 xxxxxxxxxxx	x		xxxxxxx
	4,5 xxxxxxxxxx	xxxx	xx	xxxxxxxxxx
	6,7 xxxxxxxxxxx	xxxxxxxxxxxxx	x	xxxxxxxxxxxxxxxx
	8,9 xxxxxxx	xxxxxxxxxxxxxxxxx	xx	xxxxxxxxxxxxxxxxxxxxx
	10,11 xx	xxxxxxx	xx	xxxxxxxxx
	12,13		x	xxxxxxxxxx
	14,15	xxx	xx	xxxx
				x
	-19 mm.			x
MFP -PFJ	-17,18			x
	-15,16			xxx
	-13,14			xxxxxx
	-11,12	x		xxxxxx
	-9,10			xxxxxxxx
	-7,8	xx	x	xxxxxxxxxxxxx
	-5,6	xxxxxxxx	x	xxxxxx
	-3,4 x	xxx		xxxxxxxxxxxxxxxxxx
	-1,2 xxxx	xxxxxxxxxxxxx		xxxxxxxxxx
	0,1 xxxxxxxxxxx	xxxxxxxx	xx	xxxxxxxxxxxx
	2,3 xxxxx	xxxxxxx	xxxxx	xx
	4,5 xxxxxxxxx	xxxx	xx	xxx
	6,7 xxxxxxxxxxxxxx	x	x	
	8,9 xxxx			
	10,11 xxxx	x		
	12,13 x			
	14,15 xxx			
Head Length				
	52 cm.		x	x
	51			xx
	50		xxxx	xxxxxxxxx
	49		x	xxxxxx
	48		x	xxxxxxxxxxxxxxx
	47		xxx	xxxxxxxxxxxxx
	46		xx	xxxxxxxxxxxxxxxx
	45	xx		xxxxxx
	44 xxxxx	xxx		xxxxxxxxxxx
	43 xxx			x
	42 xxxxxxxxxxxxxxxx	xxxxxxxxxxx		xxx
		xxxxxxxxx		
	41 xxxxxxxxxx	xxxxxxx		xx
	40 xxxxxx	xxxxxxxxxxxxxxxxxxx		xx
	39 xxxx	xxxxx		
	38	xxxxxxx		
	37 xx			
	36 x	x		

D. Evaluation of different variables influencing weaning weights. Burgess and Landblom (unpublished 1953), using the iterative method of solving simultaneous equations arrived at the following constants influencing the weaning weights of 546 conventional type Hereford calves out of conventional type Hereford dams.

Average weaning weight for 1946-51 inclusive 400.0 lbs.

Years effects

1946	6.38 lbs.
1947	-23.11
1948	- 3.53
1949	2.08
1950	- 1.32
1951	19.49

Age of dam effect

2 year old	-17.24 lbs.
3-5	5.16
6-8	21.60
9+	- 9.52

Sex effect

Steer	- 6.62
Bull	14.49
Heifer	- 7.88

1% inbreeding of calf - -1.75
1% " " dam - -1.17

One day of age of calf + 1.52

These constants are being used at present in adjusting the calf weaning weights to be used as a partial basis of selection.

E. The individual feeding of bull calves has been continued with the feeding of 80 bulls in 1953. Performances are reported in Gen-Series Paper 44. The bulls were again sold at auction at the end of the Annual Field Day at Fort. Lewis. The auction prices of yearling inbred bulls was approximately 18% higher than the average price received for the outcross bulls this year. This is the first time that the inbred bulls have sold for higher prices than the outbreds.

VI. Publications or Reports

Burgess, J. B. and Landblom, Nellie, 1953 - Weaning weights of Hereford Calves as affected by inbreeding, sex, and age (unpublished)

Bloom, P. E. 1953 - Analysis of beef cattle production testing in Kittitas County, Washington. Proc. W. Sect. Amer. Soc. An Prod. 1953.

Stonaker, H. H. 1953 - Selective Breeding brings new problems. Colorado Farm and Home Research 3 (5) 6.

Stonaker, H. H. 1953 - Report on the plan of the Colorado experimental beef breeding program, May 23, 1953. Colo. A. E. S. Gen Series Paper 544.

VII. Project Expenditures during 1953, see appendix.

(6834-53)

I. Cattle Inventory
A. Purebreds

BEEF BREEDING PROJECT SUMMARY
Fiscal Year 1952-53

State Colo.
Date 7/24/53

Line designation*	Brae Arden	Bonanza	Colorado	Don	Monarch	Mesa	Prospector	Animas	Royal	San Juan	Ft. Lewis	La Plata
Breed	Hereford	Pol. H				Here.	Here.	Pol. H	Here.	Here.	Here.	Here.
Station												
Bulls(12 mo. or over)	1	1	1	1	1	1	1	1	1	1	-	-
Cows (2 years or over)	17	15	13	17	16	19	11	18	14	20	-	-
Heifers, yearlings	4	5	8	5	7	1	8	1	10	3		
Male calves									9		8	
Heifer calves									6		4	
Percentage use for Breeding project			All cattle 100% used for breeding project									

Estimated cash value Bulls:$500; Cows:$200; Yearlings:$100; Calves:$60.00, Total:Value July 1,1953 = $58,140.00

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Line designation	Real Prince	Elector	Plus	Sears	Total							
Breed	Here.	Pol. H.	Here.	Here.								
Station												
Bulls(12 mo. or over)	1	1	1	1	14							
Cows (2 yrs. or over)	9	8	5	6	188							
Heifers, yearlings		1	1	1	55							
Male calves	Fall calves	1	3	4	78							
Heifer calves		5	2	2	56							
Percentage use for breeding project												
Estimated cash value												

A. Purebreds

	Herefords		Angus		Shorthorns	
	Number Individually Fed	Number Group Fed	Number Individually Fed	Number Group Fed	Number Individually Fed	Number Group Fed
Bulls	80					
Heifers						
Steers						

III. Funds expended during fiscal year 1952-53 (make estimates for remainder of year).

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Source	Amount Non-recurring items	Amount Operating Expenses *
9b3		$8300.
BAI funds		2623.18
State-controlled funds	3344.44	9869.73

* Does not include pasture feed and labor for maintaining a herd of 200 cows and yearlings and 60 bulls on feeding test.

Annual Report, 1952-53
Hawaii Agricultural Experiment Station

BEEF BREEDING PROGRAM

The beef breeding program as conducted by the Hawaii Station is designated to test breeding and growing stock under the conditions which exist in the territory and under which they are prepared for market. Since the majority of cattle are marketed "grass fat" no supplemental feeding is used. Cows are bred and calves produced and reared on range only. Bulls used are maintained on range without supplemental feeding.

Cows are pasture bred during a 120 day breeding period in segregated lots. Following the breeding season the sire groups for a particular cooperator are merged to eliminate environmental differences.

Calves are tattooed and identified as to dam and sire at birth. Weights and scores are taken at weaning time, 12 and 20 months of age.

This provides a measure of the response of sire groups and individuals under the regimen followed in actual beef production within the territory. Data obtained should be of value to all other stations due to the importance of range use to the beef producing industry.

Parker Ranch. This cooperator entered 189 cows and 6 bulls in the program beginning March 20, 1952. Essentially all cows and bulls were purebred. However, registration papers had been maintained on only 69 cows and the bulls. Distribution was at two main units of the ranch as follows:

Makahalau Unit - all hand breeding:

Sire Group	Bull	
A0	*Supreme Lamplighter 21st	24 registered cows 30 non-registered cows
A1	*Foley Farms Advance Lamplighter	15 registered cows 30 non-registered cows
A3	Colorado Aster	15 registered cows
A5	Royal Domino 22nd	15 registered cows

*Polled

Waikiki Unit - range breeding by lots:

Sire Group	Bull	
A2	Parker Sultan 26th	30 non-registered cows
A4	Parker Royal 127th	30 non-registered cows

Calving results are given in a composite sheet. The non-registered cows have all been discontinued due to management difficulties. The registered cow units will be increased to include 125 animals. Calving results are poor as a result of transition from a year round breeding program to a seasonal restricted breeding schedule.

I. Cattle Inventory

BEEF BREEDING PROJECT SUMMARY

Fiscal Year 1952-53

State Hawaii

A. Purebreds

Grades

Date 7-17-53

Line designation	A0	A1	A3	B0	BK	CT	CM	CO	CJ	E1	E2
Breed	Polled Hereford	Hereford	Polled Hereford	Polled Hereford	Polled Hereford	Polled Hereford	Polled Hereford	Polled Hereford	Polled Hereford	Hereford	Hereford
Station	Makahalau Hawaii	Makahalau	Makahalau	Kahua	Kahua	Kukaiau	Kukaiau	Kukaiau	Kukaiau	Papapala	Kapapala
Bulls(12.mo.or over)	1	1	1	1	1	1	1	1	1	1	1
Cows (2 yrs. or over	24	15	15	50	50	40	40	40	40	25	25
Heifers,yearlings	0	0	0	0	0	0	0	0	0	0	0
Male calves	8	3	6	18	13	11	13	12	19	12	10
Heifer calves	10	2	6	20	19	12	11	15	15	9	13
Percentage use for Breeding project	100	100	100	100	100	100	100	100	100	100	100
Estimated cash value	14,000	6,000	10,200	17,300	16,700	13,300	13,400	13,500	14,200	7,080	7,240

B. Grades

Line designation	A0	A1	A2	A3	A4	D1	D2	D3	D4		
Breed	Hereford	Hereford	Hereford	Hereford	Hereford	Hereford	Hereford	Hereford	Hereford		
Station	Makahalau Hawaii	Makahalau	Makahalau	Makahalau	Waikii	Kaalualu	Kaalualu	Kaalualu	Kaalualu		
Bulls (12.mo.or over)	*1	+1	1	1	1	1	1	1	1		
Cows (2 yrs. or over)	30	30	30	15	30	20	20	20	20		
Heifers,yearlings	0	0	0	0	0	0	0	0	0		
Male calves	2	0	6	0	10	7	3	7	5		
Heifer calves	2	4	9	4	9	3	10	8	6		
Percentage use for breeding project	Discont'd	Discont'd	Discont'd	Discont'd	Discontd	100	100	100	100		
Estimated cash value	›7,900	›7,900	9,800	›4,150	10,200	6,500	6,800	7,000	6,600	$199	770

*Same as in A0 for purebreds.

+Same as in A1 for purebreds.

›Does not include price of sire-to prevent duplication.

IV. Funds expended during fiscal year 1952-53 (make estimates for remainder of year).

Source	Amount Non-recurring items	Amount Salary	Amount Operating Expense	Total
9 b3				
R & M (9b 1 - 2)		$1,499.09	$762.37	$2,261.46
State-controlled funds		$ 239.14		$ 239.14

All cooperators are in the first year of the program. Each has installed scales and chutes for individual weighing and grading of animals in the program. Weaning will be accomplished during September. This will provide the first opportunity for comparison of sires.

W-1 ANNUAL REPORT for the Period July 1, 1952 to June 30, 1953
Regional Beef Cattle Improvement Project

1. Station: Idaho Agricultural Experiment Station, Moscow and Caldwell, Idaho.

2. Title of Project: The Improvement of Beef Cattle Through the Application of Breeding Methods: (1) Linebreeding within the Hereford and Shorthorn breeds. (2) By testing linebred sires within the various lines which will be developed.

   (a) Subproject: Performance testing of bull calves of purebred beef herds of the State.

3. Personnel: C. F. Sierk, T. B. Keith, R. F. Johnson, C. W. Hickman, W. P. Lehrer Jr., C. W. Hodgson

4. Progress Since 1952 Report:

   a. Additions to facilities including remodeling which will facilitate management, including record keeping and provides for feeding up to 40 steers at Moscow.

   b. Continued gathering R.O.P. data on cows and calves, including individual feeding of bull and heifer calves, photographs, etc.

   c. Twenty-two heifer calves, 3 breeds represented, individually fed to compare pelleted and non-pelleted rations.

      Results were as follows:

	Av. Initial		Av. Daily		Feed/100 lbs.
	Age	Weight	Ration	Gain	Gain
Pelleted	253	402	10.6	1.73	615.5
Non-pelleted	251	357	13.4	1.97	679.3

   d. Bulls with performance records have been placed with cooperating cattlement under formal agreement which provides for progeny test.

   e. Bull feeding at Caldwell continued.

5. Future work

   a. Continue R.O.P. records

   b. Progeny tests on bulls including carcass data, both at Moscow and Caldwell

   c. Continue supporting nutrition studies as ratio work, protein levels, etc.

BEEF BREEDING PROJECT SUMMARY
Fiscal Year 1952-53

I. Cattle Inventory
A. Purebreds

State - Idaho
Date - July 1, 1953

Breed	Hereford	Shorthorn	Angus
Station	Moscow	Moscow	Moscow
Bulls (12 mo. or over)	12	7	2
Cows (2 yrs. or over)	50	25	17
Heifers, yearlings	12	10	4
Male calves	13	5	2
Heifer calves	11	7	6
Percentage use for breeding project	90	90	90
Estimated cash value	32,000	20,000	9,500

II. Young animals which were on feed during 1952-53.

A. Purebred

	Hereford Number Individually Fed	Angus Number Individually Fed	Shorthorn Number Individually Fed
Bulls	13 at Moscow 19 at Caldwell	5	7
Heifers	7	3	12
Steers	5	3	5

III. Additions of land, physical facilities and equipment during fiscal year 1952-53.

Item	No.	Actual cash value	Percentage use for beef breeding project
Alterations to barns and corrals	6	29,500	90

IV. Funds expended during fiscal year 1952-53

Source	Amount Non-recurring items	Amount Operating expense
9-b3	600	4,400
State-controlled funds	30,500*	13,400

*Includes $29,500 reported under III

REGIONAL CATTLE BREEDING LABORATORY July 1, 1953

Station: Montana Agricultural Experiment Station and the North Montana Branch Station at Havre, Montana.

Title of Project: W-1, M.S. 873, A.1. 104, North Montana Branch Station 71. The Improvement of Beef Cattle thru the Application of Breeding Methods.

A. 1. The establishment of inbred lines of registered Hereford cattle, both horned and polled, that will result in improvement in such characters as rate and economy of gain, fertility, nursing ability, longevity, and carcass quality.

2. Maintain an outbred herd of Herefords with bulls selected and furnished by the purebred breeders. The bulls are to be primarily good, high scoring individuals according to breed association standards.

B. Establishment of an improved herd of registered Angus cattle in which the males are selected on a high level of performance as indicated by standard record of performance procedures.

C. Investigate feasibility of breeding for specific combining ability through recurrent selection.

Present Status and Accomplishments

There are 3 lines of purebred Herefords at Havre, one of which is polled. The designation of the Havre lines and their origin is as follows:

HL 1 - Polled line of Dingwall breeding
HL 2 - Horned line, Higgins breeding
HL 3 - Horned line, Sim and Shock breeding
3 test herds last year
6 test herds this year

This permits progeny testing the two top feed-test indexing bulls in a recurrent test for combining ability. A high grade Hereford herd of line 1 Miles City cattle are maintained as tester stock. Whenever a young bull exceeds the herd bull in a line in test cross performance he will replace the older sire. The first year cross-line steer test calves were group full-fed a fattening ration and a slaughter test was obtained at the end of a 196-day feeding period. Eight steer calves were fed per progeny group where numbers permitted and a control group of straight Miles City line 1 steers were also fed.

At the end of 168 days of feeding mean daily gain and weight for the test cross steer calves and the control line 1 steers were as follows:

	DA. GAIN	AVG. Wt.
HL 1 No. 545 Progeny =	2.07 lb.	854 lb.
HL 2 No. 536 Progeny =	2.18 lb.	862 lb.
HL 3 No. 507 Progeny =	2.14 lb.	839 lb.
Miles City L1 No. 293 =	2.27 lb.	869 lb.

It should be noted that the Miles City line 1 steers performed slightly better on feed test than any of the crossline calves.

The first year's data serves only as a control to compare sires for future years in each crossline, since there was no opportunity to select between bulls within lines this year with respect to the recurrent phase of the study. Each of the two-year old bulls which had been progeny tested were used in their respective lines this year, excepting of course, the Miles City LI bull.

Carcass data has not been summarized as yet, but it is anticipated that future years' data on crossline steer carcasses will be summarized before bulls go into line herds. However, carcass grades showed 22 choice, 8 top good and 1 commercial. Live and carcass grades and carcass measurements, including area of rib-eye muscle were taken on each carcass.

The three crossline heifer progeny groups ranked in the same order as did the full-fed steer progeny on rate of gain. The heifers were given 3 to 5 lbs. grain per head daily plus first cutting alfalfa hay, ad lib. during the wintering period.

In addition to the crossline steers the Havre Station group-fed 20 cross line heifer calves and 39 replacement heifer calves. Twenty-four head of yearling steers representing 3 sire groups were individually full-fed for a 112-day feeding period. This was the last of a 7 year study comparing feed lot gains with gains on good mountain range. Indications are that the sire groups that do the best on the range also do the best in the feed lot. The carcasses all graded choice.

There were 27 bull calves from the three lines indexed according to standard R.O.P. procedure. The usual variation of around a pound a day in average daily gain and 187 lbs. in feed efficiency was observed. After two top calves from each line were selected for test breeding, the excess bulls were sold at public auction.

At the Bozeman Station: There are three herdsmaintained. Line A, a horned Hereford inbred group of 30 breeding females were bred to a top indexed two-year old bull of our own raising. Five cows were bred to a top indexed yearling bull of our own raising.

Line B: A group of 12 to 14 outbred horned Hereford cows are maintained and bred to a show type bull selected and furnished by the purebred breeders. In this group the major emphasis ison type, conformation and quality with less emphasis on gaining ability and feed efficiency.

Line C is an Angus herd of 23 breeding females in which the bulls are selected on their indexing performance and visual appraisal without reference to in-breeding. The 3-year old top indexed bull of our own raising was used on this herd. The results of these three selection procedures will not be apparent for some time.

There were 8 Hereford and 5 Angus heifer calves group-fed for possible replacements. Eight Hereford and five Angus bull calves were indexed using standard R.O.P. procedure. There were two sire groups each of Herefords and Angus. There was a variation in average daily gain of .7 lb. and 175 lb. in feed efficiency.

Indexing of bulls for private breeders at the Station was discontinued. It was felt that six years of this service to the purebred breeders had served the purpose of publicizing the method, and demonstrated its value as a selection procedure for improving economic factors in beef cattle. The results were published in the Montana Agricultural Experiment Station Bulletin 487 in February, 1953.

The extension livestock specialist and county agents continued to assist private breeders with indexing bulls on the ranchor's place. In addition, they helped set up the first producer organized group in Montana, the Maria Hereford Brdders Association of Shelby, which indexed 62 bulls.

Supplemental Data on Havre Crossline Progeny Groups
Slaughter Steers

	HL 1	HL2	HL 3	MC 1
Sales Wt.	853	863	836	863
Dressing %	59.7	59.0	60.1	59.5
Grade: *				
Feeder	69	69	66	67
Slaughter	72	77	73	74
Carcass	76	73	74	71
Price Per CWT.(Rail)	36.88	36.50	36.85	36.63
Gross Receipts (per head)	188.06	185.73	186.06	188.35
Carcass Data				
Body Length	1152	1159	1134	1166
Length leg	727	734	734	739
Cir. Round	870	881	857	866
Width round	471	469	472	475
Width shoulder	407	410	407	406
Body depth	374	382	392	377
Loin length	602	605	593	606
Rib eye sq. in.	10.22	10.03	10.76	10.77
Fat thickness				
Awg. 3 meas.	15.4	13.3	13.7	13.3
Choice	7	4	6	5
Good	1	4	1	3

* 75 - 85 = choice
60 - 70 = good
45- 55 = commercial

3. Cattle Inventory — BEEF BREEDING PROJECT SUMMARY — State Montana

A. Purebreds — Havre — Fiscal Year 1952-53 — Bozeman — Date 7-1-53

Line designation	H.L. 1	H.L. 2	H.L. 3			Line A	Outbred B		Line C				
Breed	Polled Hereford	Herf.	Herf.			Herf.	Herf.		Angus				
Station	N.M. Br.St.	N.M. Br. St.	N.M. Br. St.			Bozeman	Bozeman		Bozeman				
Bulls Mature	3	3	2			1	1*		1				
Bulls(12 mo. or over)	3	3	3			8			5				
Cows(2 yrs. or over)	26	29	28			24	12		19				
Heifers, yearlings	9	8	8			6	2		4				
Male calves	4	14	10			7	3		5				
Heifer calves	4	8	6			10	1		10				
Percentage use for breeding project	100	100	100			60	60		60				
Estimated cash value	13,550	15,700	14,000			13,800	4,300		9,800				

B. Grades

Line designation	MC Tester
Breed	Hereford
Station	N.M. Br. St.
Bulls mature	1*
Bulls(12 mo. or over)	
Cows(2 years or over)	154
Heifers, yearlings	24
Male calves	46
Heifer calves	46
Percentage use for breeding project	100
Estimated cash value	39,000

A. Purebreds at the Bozeman Station

	Herefords		Angus		Shorthorns	
	Number Individually Fed	Number Group Fed	Number Individually Fed	Number Group Fed	Number Individually Fed	Number Group Fed
Bulls	8		5			
Heifers		8		4		
Steers						

B. Grades

Bulls						
Heifers						
Steers						

A. Purebreds at the North Montana Branch Station

Bulls	27					
Heifers		39				
Steers						

B. Grades

Bulls						
Heifers		20				
Steer calves		57				
Steer yrgs.	24					

5. Additions of land, physical facilities and equipment during fiscal year 1952-53.

BOZEMAN

Item	No.	Actual Cash Value	Percentage use for beef breeding project	Remarks
Feed mixing plant with overhead bins, scales, etc.	1	$6,000	25%	This plant completed and put in operation

HAVRE

Stock scale	1	1,000	100%	At headquarters
Rebuilt feed lots	9	1,500	100%	At headquarters
Built 1 mile of new fence		400	100%	In mountains
Grand total		$8,900		

6. Funds expended during fiscal year 1952-53 (make estimates for remainder of year)

Source	Amount Non-Recurring Items	Amount Operating Expense	Total
9 b3	None	5,000	5,000
E.I Funds	None	2,400	2,400
State-controlled Funds	8,900	32,400	41,300
		1952-53 Grand Total	$48,700

W-1 ANNUAL REPORT for the period July 1, 1952 to June 30, 1953

1. Station: Nevada Agricultural Experiment Station.

2. Title of Project: The correlation of weight with age, conformation, vigor and fertility when Herefords are moderately inbred.

3. Personnel: James F. Kidwell, Verle R. Bohman, Wallace G. Black, James E. Hunter, Thomas C. Cook.

4. Accomplishments: The improvement of physical facilities continues to occupy much time. Four bulls and nine steers were individually fed a pelleted test ration at Reno last year. Five purebred heifers were individually fed at Knoll Creek. Twenty-four heifers were used at Knoll Creek to study the relation between individual and group feeding. It was determined that under prevailing conditions, there is a distinct difference in gain between animals fed as individuals and in groups. Four metabolism stalls were completed and techniques for nitrogen balance and antipyrene tests developed.

Accumulated data concerning the relation between gains made at different periods has been analyzed. A paper is being prepared.

Three purebred lines have been established at Reno and two grade lines at Knoll Creek.

5. Present status: The project is being evaluated on the basis of results to date and in the light of current knowledge.

6. Future plans: A project revision has been under intensive study for some time. The revised project will include studies of selection criteria, methods of selection, growth and development, estimation of population parameters, and studies of fertility. Whenever possible the action of individual genes will also be studied.

A. Purebreds — Fiscal Year 1952-53 — Date July 31, 1953

Line designation	I	II	III
Breed	Hereford	Hereford	Hereford
Station	Reno	Reno	Reno
Bulls (12 mo. or over)	3	3	2
Cows (2 yrs. or over)	23	22	22
Heifers, yearlings	2	1	2
Male calves	5	8	6
Heifer calves	9	7	8
Percentage use for breeding project	100	100	100
Estimated cash value	$10,000	$9,550	$9,300

Line designation	I	II
Breed	Hereford	Hereford
Station	Knoll Creek	Knoll Creek
Bulls (12 mo. or over)	1	1
Cows (2 yrs. or over)	12	12
Heifers, yearlings	12	12
Male calves	4	6
Heifer calves	5	5
Percentage use for breeding project	100	100
Estimated cash value	$4,300	$4,300

II. Young animals which were on feed during 1952-53.

A. Purebreds

	Herefords		Angus		Shorthorns	
	Number individually fed	Number group fed	Number individually fed	Number group fed	Number individually fed	Number group fed
Bulls	4					
Heifers	5					
Steers	9					

B. Grades

Bulls						
Heifers	24					
Steers						

IV. Funds expended during fiscal year 1952-53 (make estimates for remainder of year).

Source	Amount Non-recurring items	Amount Operating expense
9 b 3	$ 150.00	$3,250.00
BAI funds		
State-controlled funds	$ 10,200.00	$2,000.00
9 b 1 & 2	$ 350.00	$8,750.00

III. Additions of land, physical facilities and equipment during fiscal year 1952-53.

Item	No.	Actual Cash Value	Percentage use for beef breeding project	Remarks
Calculator	1	$675.00	90	
Metabolism stalls	4	800.00	80	
Laboratory equipment		6,000.00	80	This includes equipment for nutrition and physiology labs.

W-1 ANNUAL REPORT FOR THE PERIOD July 1, 1952 to June 30, 1953

1. STATION: New Mexico

2. TITLE OF REPORT: Breeding Beef Cattle for Southwestern Ranges

3. PERSONNEL: Ralph Durham, J. H. Knox

4. PROGRESS SINCE LAST REPORT:

The first calf crop has arrived under the revised project. It is anticipated that this new phase of work, i.e. crossing the types, will aid in clarifying some unanswered questions about the productivity of the differing types of cattle.

The fifth year of feeding samples of steers from the two types of cow herds has ended. This year's data did not differ in trend from the previous four years. Work in preparing the data on feed lot and carcass performance for publication is now in progress. It is anticipated that the paper will be submitted in late summer.

Lignin determinations have been made on feces collections from large and compact range cattle. The lignin voided by large 2-year-old heifers averaged 125 peercent of that voided by compact heifers of 1952-53. The average ratio of large to compact weights was 119 percent. Lignin collections varied from 115% to 133% and weights from 118 to 122 percent.

A paper on the associations between grades and gains between grades at different times has been accepted for publication in the Journal of Animal Science. A summary of this paper is as follows:

1. Grade at the beginning of a period tended to be negatively associated or not associated at all with the subsequent gain.

2. Gain during the fattening period was associated with subsequent grade.

3. Yearling grade had a low, but significant, association with carcass grade.

4. No correlation exists in these data between weaning grade and carcass grade.

A paper on the analysis of variation in calving intervals has been submitted for publication. In brief this is a summary of the findings:

1. No heritable variation in calving intervals was found.

2. No repeatability of calving intervals was found.

3. Year and sequence of calving had significant effects on calving interval variation.

Studies are progressing on the association of weight and body surface. An analysis of carcass cutout values is also being made on the different types of cattle fed out, and on different breeds.

Work on developing a dwarf free line of cattle is progressing. To date this has been slow since three bulls have tested out to be carriers and one which apparently was clean died.

An analysis of gestation length was done on Angus and Hereford data. The Herefords had significantly longer gestation periods. Within the Angus breed the heritability of gestation length was found to be 0.16 and the repeatability 0.14.

5. SUMMARY OR CONCLUSIONS TO DATE:

See above.

6. WORK PLAN FOR THE FUTURE:

Analysis of the data is continuing with particular emphasis on components of variation in cow production. The new phase of the experiment will require time for the accumulation of cross-type mating data.

7. PUBLICATIONS such as Journal articles, experiment stations bulletins, etc.

Durham, R. M. and J. H. Knox. 1953. Correlations between grades and gains of Hereford cattle at different stages of growth and between grades at different times. Journal of Animal Science. (In press).

Schwarz, Mario. 1953. An analysis of the variance in gestation length in Aberdeen Angus, and Hereford cattle. M. S. thesis.

Brown, L. O., R. M. Durham, Estel Cobb, and J. H. Knox. 1953. An Analysis of the components of variation in calving intervals in range beef cattle. (Submitted to the Journal of Animal Science). This is Mr. Brown's M. S. thesis work.

J. H. Knox and R. M. Durham. 1953. Comparative feed lot and carcass performance of calves from compact and large type groups of cows. (In preparation)

Durham, R. M. and J. H. Knox. 1953. A study of the association between size and performance in range beef cows. (In preparation)

Hudson, Frank, Estel Cobb, J. H. Knox, and R. M. Durham. 1953. Relationship of type to yield, weight of wholesale cuts, and hide areas. (In preparation) This is Mr. Hudson's thesis work.

8. SUGGESTIONS FOR IMPROVEMENT OF OVER-ALL W-1 PROJECT.

It is suggested that the Regional Coordinator prepare and disseminate a monthly news letter informing all stations of progress in his office and at the various stations.

I. Cattle Inventory

A. Purebreds

BEEF BREEDING SUMMARY

Fiscal Year 1952-53

State New Mexico

Date July 1, 1953

Line designation	old line	Outcross line									
Breed	Hereford	Hereford									
Station	Main	Main									
Bulls(12 mo. or over)	3	11									
Cows(2 yrs. or over)	14	29									
Heifers, yearlings	1	15									
Male calves	8	9									
Heifer calves	2	11									
Percentage use for Breeding project	65%	65%									
Estimated cash value	$8,100	$17,200									

B. Grades

Line designation	Big		Medium		Compact						
Breed	Hereford		Hereford		Hereford						
Station	Main		Main		Main						
Bulls(12 mo. or over)	--		--		--						
Cows(2 yrs. or over)	38		67		35						
Heifers, yearlings	--		23		--						
Male calves	14		29		13						
Heifer calves	15		27		13						
Percentage use for breeding project	50%		30%		50%						
Estimated cash value	$5,250		$11,225		$4,800						

II. Young animals which were on feed during 1952-53

A. Purebreds

	Herefords		Angus		Shorthorns	
	Number Individually Fed	Number Group Fed	Number Individually Fed	Number Group Fed	Number Individually Fed	Number Group Fed
Bulls	11					
Heifers						
Steers						

B. Grades

	Group Fed				
Bulls					
Heifers					
Steers	20				

IV. Funds expended during fiscal year 1952-53 (make estimates for remainder of year).

Source	Amount Non-Recurring Items	Amount Operating Expense
9 b3		$9,000.00
BAI Funds		3,962.00
State-controlled funds	8,500 (¼ of 34,000)	7,723.91

III. Additions of land, physical facilities and equipment during fiscal year 1952-53.

Item	No.	Actual Cash Value	Percentage use for beef breeding project	Remarks
Feed lots, laboratory and storage buildings	1	34,000	25%	

Report on the W-1 Beef Cattle Project from the Oregon Station*
July 24 and 25, 1953
by
Ralph Bogart

Lines of Cattle:

Three lines of purebred Herefords and one line of purebred Angus are being developed at the Central Station using a selection index with equal weight given to suckling gains, feed-lot gains, feed efficiency, and score. Some culling on fertility has been done on a minimum-level basis. The test period for feed-lot gains and efficiency is from a live weight of 500 to a weight of 800 pounds. Initially the calves were fed 3 parts chopped alfalfa hay to 1 part of concentrate from 500 to 600 pounds weight; 2 parts hay to 1 part concentrate from 600 to 700 pounds weight; and 1 part hay to 1 part concentrate from 700 to 800 pounds body weight. During the past year the calves have been fed a completely pelleted ration composed of 2 parts half-ground green leafy alfalfa hay to 1 part concentrate. The composition of the pelleted ration is shown in table 1. The ration is quite palatable and digestibility is higher than one might expect (table 2) with the results that rate and economy of gains have been very good (table 3).

Table 1. Percent of Ingredients Used in Pelleted Ration.

Feedstuff	Per cent of Ration
Alfalfa Hay	66.5
Molasses	5.0
Barley, steamed rolled	15.0
Oats, ground	5.375
Beet pulp, dried	3.25
Wheat bran	2.25
Soybean oil meal, 44%	1.75
Linseed meal, 32%	.35
Steamed bone meal	.175
Salt, iodized	.15
Skimmilk, dried	.2
Yeast, irradiated	3 oz. per ton

*Ralph Bogart is responsible for overall coordination of the Beef Cattle Breeding Research in Oregon. Work at the Eastern Oregon Station, Union, is done by H. G. Avery and Cecil D. Pierce. Studies at the Squaw Butte-Harney Station, Burns, are being done by W. A. Sawyer and Farris Hubbert, Jr. Supporting work has been done at the John Jacob Astor Station, Astoria, and the Malheur Experimental Area, Ontario. Physiology studies were formerly directed by A. C. Warnick and are now under the direction of Hugo Krueger. Carcass studies and meats evaluation research is done by A. W. Oliver, J. E. Oldfield and Mrs. Andrea Overman Mackey. Statistical whork which has been done by Mrs. Mina Ruth Galey, Mrs. Ruth Gysbers, and Martin J. Burris has had the counsel of J. C. R. Li.Graduate students, including Robert Blackwell, Martin J. Burris, J. J. Dahmen, M. A. MacDonald, George Nelms, M. M. Oloufa, Robert Tether and C. M. Williams, have contributed greatly to carrying on the research program. Valuable assistance to the program has come from Fred F. McKenzie, J. B. Johnson and John Kaufmes.

Table 2. Composition of Ration and Digestibility of Nutrients.

Nutrient	Total Per Cent	Digestible Per Cent
Dry matter	88.8	--
Protein	13.9	9.57
Fiber	22.2	8.63
Ether extract	5.5	4.75
Mineral matter	8.8	--
N-free extract	44.06	42.01
TOTAL DIGESTIBLE NUTRIENTS		64.97

Table 3. Average Rate of Gain and Efficiency of Beef Calves Fed the Pelleted Ration.

	Angus		Hereford		All	All
	Bulls	Heifers	Bulls	Heifers	bulls	heifers
Rate of gain	2.87	1.97	2.91	2.26	2.90	2.13
TDN/100# gain	404	610	382	521	389	560

Improvement has been made in rate and economy of gains in all four lines in the one generation of cattle covered by the Oregon Station even though inbreeding approaching that of half-sib matings has been practiced (table 4). The progress in rate of gain has been more striking than that in feed efficiency.

Table 4. Average Initial Rate of Gain and Feed Efficiency Compared With the present for the 4 lines of Cattle at the Oregon Station Along With Present Inbreeding.

Line	Rate of gain		Feed Efficiency*		1952-53
	Initial	1952-53	Initial	1952-53	Inbreeding %
Angus - Bulls	2.51	2.87	400	371	10.5
Heifers	1.78	2.13	565	559	
Lionheart - Bulls	2.30	3.12	460	341	9.9
Heifers	1.70	2.34	572	505	
Prince - Bulls	2.35	2.43	366	370	8.4
Heifers	1.94	2.20	480	455	
David - Bulls	2.17	2.75	428	363	16.7
Heifers	1.95	2.26	500	483	

*TDN per 100 lbs. gain.

There have been several kinds of abnormal calves produced in the Angus line but none of the lines of Herefords have had noticeable defects.

Eastern Oregon Branch Station, Union

One line of purebred Herefords based on Donald Dhr breeding is being developed at the Eastern Oregon Branch Station, Union. The selection is based on equal weight for suckling gains, feed lot gains, feed efficiency and score. Calves are fed 2 parts concentrate to 1 part chopped mixed alfalfa and grass hay. Feed testing at this branch station is conducted for a given period of time rather than for a given amount of gain. Bull calves have increased 0.29 pound per day in average feed lot gain during the 3-year period. This increased gain has been accompanied by an average decrease of 60 lbs. T.D.N. per 100 lb. gain.

A detailed study was made on 46 calves individually fed and 160 calves lot fed at the branch station at Union during 1949-52. Multiple correlations were set up to test the single and combined effects of the four independent variables--birth weight, suckling gain, weight-on-test, and age-on-test--on each of the three dependent variables--gain on test, economy of gain (total digestible nutrients per 100 pounds gain), and gain per day from birth to the end of the test period.

Two separate analyses were run at the Union Station, one on the individually fed calves and one on the group fed calves. The conclusions are presented in that order.

(a) Stall Fed Calves (at Union, Oregon)

1. Birth weight had a significant effect on gain-on-test and on gain-from-birth-to-the-end-of-the-test period. Calves 10 pounds heavier than average at birth gained 0.13 pound per day more on test, and 0.043 pound per day more from birth to the end of test.

2. Gain per day during the suckling period had no effect on gain-on-test or gain-from-birth-to-the-end-of-test.

3. Age-on-test had a positive effect on gain-on-test. For each additional 10 days in age above the mean at the beginning of the test, there was a added 0.04 pound per day gain on test.

4. Weight-on-test had a positive effect on gain-from-birth-to-the-end-of-test. Calves 10 pounds heavier than average at the beginning of the test period gained 0.02 pounds per day more throughout the total period from birth to the end of test.

5. Economy of gain was not affected by birth weight, suckling gain, weight-on-test, or age-on-test.

6. There was a significant regression of economy of gain on rate of gain. An increase of 0.1 pound per day above the mean in gain on test resulted in a saving of 23 pounds of total digestible nutrients for each 100 pounds gain in live weight. See tables 5 and 6.

Table 5. Partial Regression Coefficients and Confidence Intervals of Gain-on-Test in Pounds per Day, on Birth Weight in Pounds, and Age-on-Test in Days.

Variate	Partial Regression Coefficient (b)	Units	95 percent Confidence Interval of b
Birth Weight	.013	lbs.per day/lb.	.005 to .021
Age on Test	.004	lbs.per day/day	.003 to .005

Table 6. Partial Regression Coefficients and Confidence Intervals of Gain-From-Birth-to-End-of-Test in Pounds per Day, on the Two Variables, Birth Weight in Pounds and Weight-on-Test in Pounds.

Variate	Partial Regression Coefficient (b)	Units	95 percent Confidence Interval of b
Birth Weight	.004	lbs.per day/lb	.000 to .008
Weight on Test	.002	lbs.per day/lb	.001 to .003

(b) Lot Fed Calves

1. Birth weight had a significant positive effect on gain-on-test and on gain-from-birth-to-the-end-of-test. An additional 10 pounds above the mean at birth resulted in 0.41 pounds added gain per day on test and 0.083 pounds added gain per day from birth to the end of the test. In both phases of this study, calves heavier at birth gained faster on test and from birth to market age.

2. Suckling gain had a significant positive effect on gain-on-test and on gain-from-birth-to-the-end-of-test. An increase of 0.1 pound above the mean in suckling gain per day resulted in an increase gain per day on test of 0.379 pounds and an increase in gain per day from birth to the end of test of 0.074 pounds. This effect was not significant with the stall fed calves.

3. Weight-on-test had a significant negative effect on gain-on-test. Calves which were 10 pounds heavier than average at the beginning of the test gained 0.14 pounds per day less on test.

4. Age-on-test had a significant positive effect on gain-on-test. Calves 10 days older than average at the beginning of the test gained 0.36 pounds per day more during the test period.

5. Age-on-test and weight-on-test had no significant effect on gain-from-birth-to-the-end-of-test.

6. There was a significant positive correlation between suckling gain and weight-on-test and between weight-on-test and age-on-test.

7. There was a significant negative correlation between suckling gain and age-on-test. Calves younger at the beginning of the test period had made higher suckling gains over a relatively shorter period of time. Calves which were heaver at the beginning of the test had gained less per day during the suckling period but had made a greater total suckling gain because of their greater age at weaning. See tables 7, 8, 9).

Table 7. Partial Regression Coefficients and Confidence Intervals of Gain-on-Test in Pounds per Day on Birth Weight in Pounds, Suckling Gain in Pounds per Day, Weight-on-Test in Pounds, and Age-on-Test in Days.

Variate	Partial Regression Coefficients (b)	Units	95 percent Confidence Interval of b
Birth Weight	.041	lbs.per day/lb	.025 to .057
Suckling Gain	3.79	$\frac{\text{lbs.per day}}{\text{lbs. per day}}$	2.03 to 5.55
Weight on Test	-.014	lbs.per day/lb.	-.007 to -.022
Age on Test	.036	lbs.per day/day	.019 to .053

Table 8. Correlation Coefficients of Suckling Gain in Pounds per Day with Weight-on-Test in Pounds, Suckling Gain in Pounds per Day with Age-on-Test in Days, and Weight-on-Test in Pounds with Age-on-Test in Days.

Interaction	r
Suckling Gain with Weight-on-Test	0.590
Suckling Gain With Age-on-Test	-0.405
Weight-on-Test with Age-on-Test	0.428

Table 9. Partial Regression Coefficients and Confidence Intervals of Gain from Birth to End of Test in Pounds per Day, on Birth Weight in Pounds and Suckling Gain in Pounds per Day.

Variate	Partial Regression Coefficient (b)	Units	95 percent Confidence Interval of b
Birth Weight	.006	lbs.per day/lb	.004 to .008
Suckling Gain	.522	$\frac{\text{lbs.per day}}{\text{lbs.per day}}$	.431 to .613

8. It appears that the suckling period is subject to considerable environmental influence. Whether or not test calves are weaned at a constant age, they should undergo a conditioning period before being placed on official test.

9. This study indicates that production testing may be more valid if calves are fed through either a weight constant or an age constant period. Under range conditions where such controls are impractical, adequate correction factors would be used to standardize test procedures.

Squaw-Butte-Harney Branch Station, Burns.

One line of grade Herefords is used at the Squaw Butte-Harney Station for application research. Feed-tested bulls from the Prince line of the Central Station are used on the nucleus herd of 30 cows. The heifers from these cows and some of the better range heifers are feed tested and the better doing ones are used in the range herd. Tested bulls are also used on the range herd. The plan is to demonstrate a means of employing selection on a production basis even in herds where it is not possible to obtain production records. Another phase of the work at this station isto determine if selections can be made for greater rate and efficiency of gains when the cattle are handled primarily on roughage and certainly not at an optimum level. The data indicate that cattle show differences in rate and efficiency even on a lower plane of nutrition and that selection under these conditions will be effective. It was found, for example, that 2 animals on the lower-level ration and one on the higher-level ration made gains one standard deviation above the mean during both the winter and the summer periods.

In a study of the factors influencing weaning weight of calves, it was found that age of dam, weight of dam and birth weight of calf all influence weaning weights. Calf-weaning-weight increases with increasing age of dam up to 8 years (table 10). The effect of each of the variables, i.e., age of dam, birth weight

Table 10. Effect of Age of Dam on Weaning Weight of Calf.

Age of Dam	Number of Pairs	Average Weaning Weight in Pounds
2	44	272
3	67	296
4	61	322
5	40	343
6	51	339
7	42	348
8	47	355
8 (over)	80	336

of calf, and weight of dam on weaning weight of calf is shown in table 11. The following conclusions seem warranted:

Table 11. Confidence Intervals and Average Regression of Weaning Weight on Age of Dam, Birth Weight of Calf and Weight of Dam.

B_1= Age of Dam	1.29 to 4.41	(2.85)
B_2= Birth Weight of Calf	1.49 to 2.78	(2.14)
B_3= Weight of Dam	0.11 to 0.18	(0.15)

1. When birth weight of calf and weight of dam are held constant each year of age of the dam accounts for 1.29 to 4.41 (2.85) lbs. difference in weaning weight of the calf.

2. When age of the dam and weight of the dam are held constant, each difference of one pound at birth is associated with a difference of 1.49 to 2.78 (2.14) lbs. in weaning weight of calf.

3. When age of dam and birth weight of calf are held constant, each 100 lb. difference in weight of dam is associated with 11 to 18 (15) pounds difference in weaning weight of calf.

4. Approximately 23 percent of the variations in weaning weight of calves is accounted for by differences in birth weight, age of dam, and size of dam.

Since calves are weaned at Burns at a constant date rather than a constant age it is necessary to correct or adjust the weight of the calves to a common-age basis. The range calves at the Squaw Butte-Harney Station on sagebrush-bunch grass range were gaining 8.9 lbs. per week and the growth curve was a relatively straight line (figure 1); therefore, this figure of 8.9 lbs. per week or 1.29 lbs. per day was used for adjusting weights to a common age which was 32 weeks in the figures given in table 10.

Central Station, Corvallis

The early work at Oregon at the Central Station showed that bulls and heifers differ markedly in both rate and economy of gains when tested on a weight-to-weight-constant basis. Thus in the feed tests conducted from a weight of 500 lbs. to a weight of 800 lbs. bulls gained faster and required less TDN per unit of gain than heifers.

It seemed desirable to test the relative merit of feeding for a given number of days and of feeding for a given amount of gain. When calves were fed to gain a given amount of weight, there was a significant correlation between time and feed required to make the gain (table 12 and figure 2). When calves were fed for a given period of time, correlations of gains made with feed consumed lacked significance (table 13 and figure 3). These two observations were made at the same general area in the life of the calves and covered about the same gain and time, but they show clearly that differences in feed efficiency can be more easily discerned by feeding on a basis of constant gain than on the basis of a constant number of days on test. The better gainers are penalized on a time-constant basis whereas the poor doing animals are penalized on a gain-constant basis. In the case of the constant amount of gain, feed-efficiency differences are exaggerated; whereas, on a constant-time feeding program, differences in feed efficiency are minimized. Therefore it appears that testing animals for feed efficiency is more usable when they are fed to make a given amount of gain rather than for a given period of time.

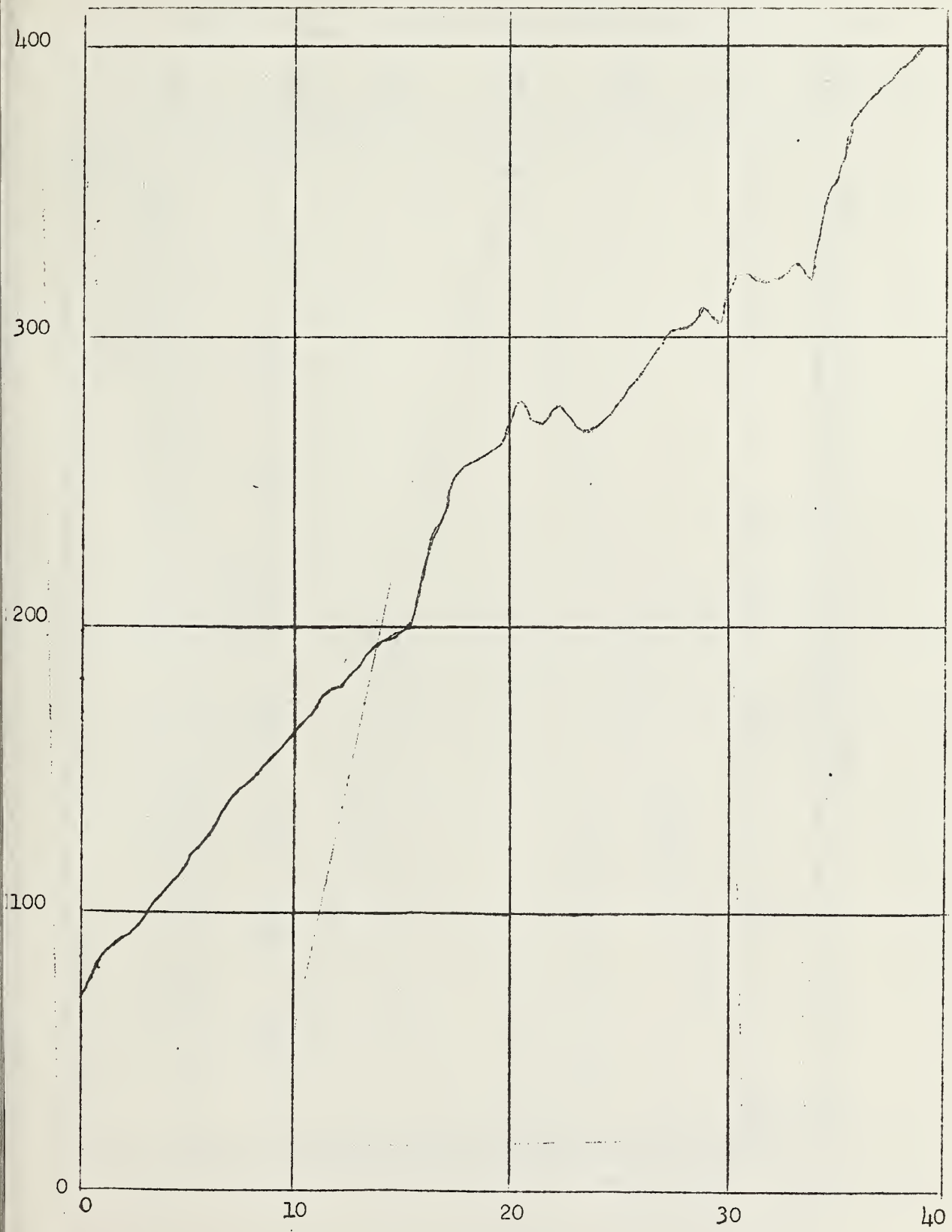

Figure 1. Weight of calves according to age

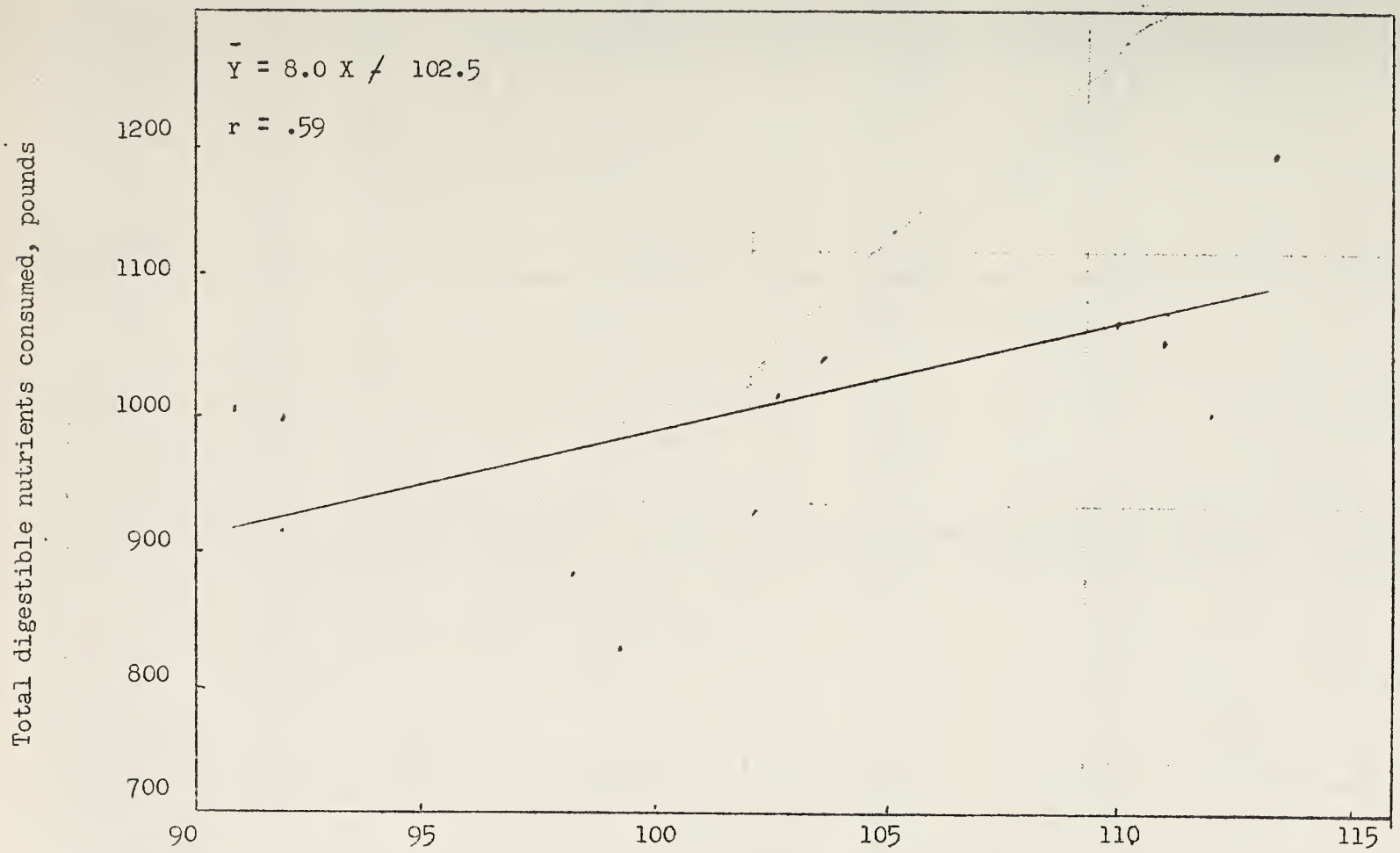

Figure 2. Correlation between total digestible nutrients consumed and time required to gain 250 pounds for bulls with initial weight of 250 pounds.

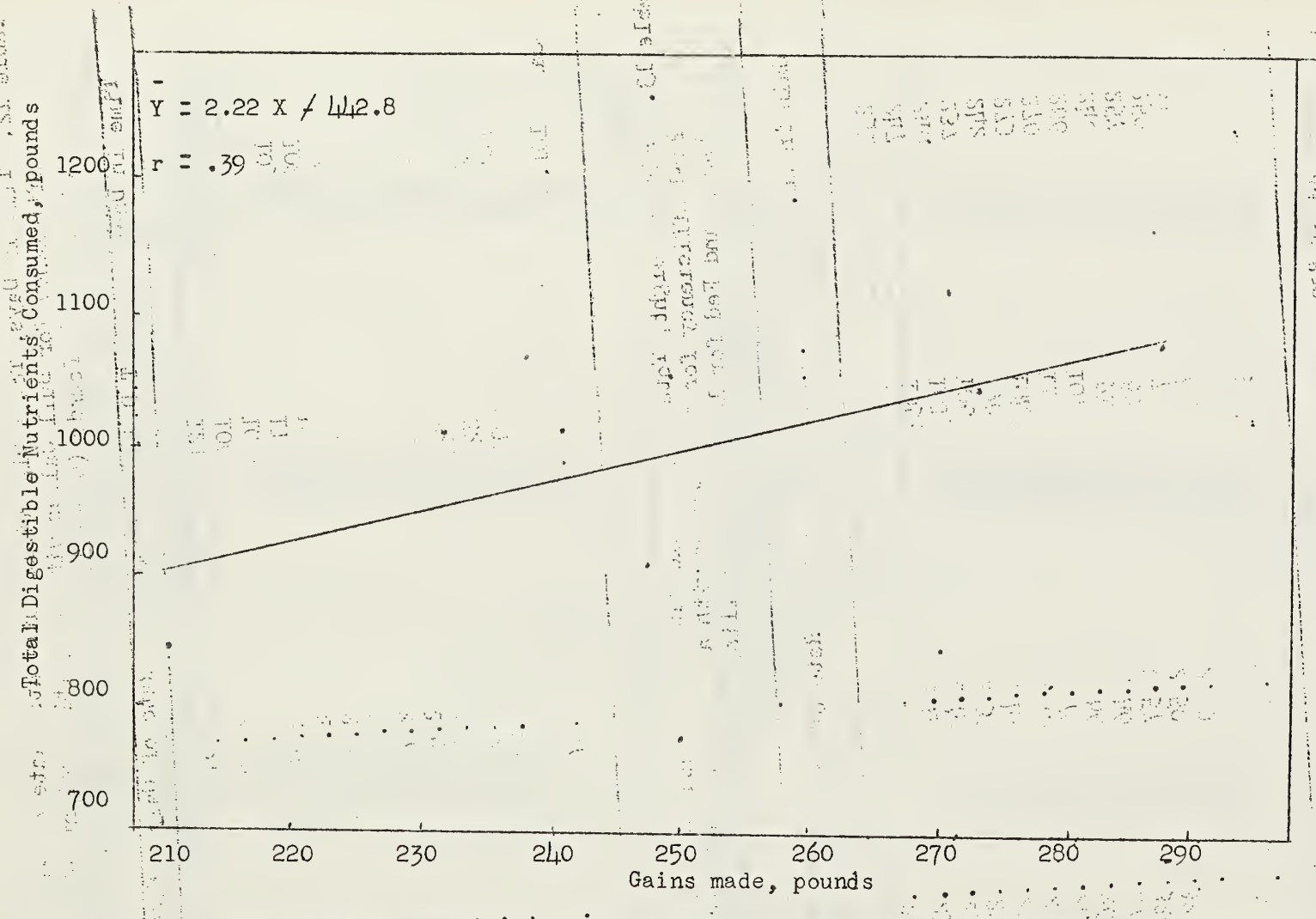

Figure 3. Correlation between total digestible nutrients consumed and gains made during 100 days of feeding for bull calves having an initial weight of 550 pounds.

Table 12. Time in Days, Total Digestible Nutrients, Rate of Gain, and Feed Efficiency for Bull Calves with an Initial Weight of 550 Pounds and a Gain of 250 Pounds (Corvallis)

Time in Days	T.D.N. Consumed	Rate of Gain	Feed Efficiency
113	1210	2.21	.207
111	1067	2.25	.234
103	1055	2.42	.237
105	1136	2.38	.220
102	1009	2.45	.248
92	923	2.72	.271
91	1003	2.74	.249
92	998	2.72	.251
102	942	2.45	.265
98	888	2.55	.282
99	826	2.53	.303
112	1013	2.23	.246
Mean 101.6	1005.8	2.47	.251

Table 13. Gain in Weight, Total Digestible Nutrients Consumed, Rate of Gain and Feed Efficiency for Bull Calves with an Initial Weight of 550 Pounds and Fed for 100 Days (Corvallis)

Gain in Lb.s	T.D.N. Consumed	Rate of Gain	Feed Efficiency
231	1014	2.31	.228
247	1055	2.47	.234
240	1013	2.40	.237
237	1069	2.37	.222
242	980	2.42	.247
273	1046	2.73	.261
270	1125	2.70	.240
286	1078	2.86	.265
246	910	2.46	.270
257	804	2.57	.320
250	776	2.50	.322
210	840	2.10	.250
Mean 249.1	975.8	2.49	.258

Up to a weight of 800 pounds, gain-per-day goes up as the cattle get older and bigger (figure 4) with bulls showing a greater increase in gains with increasing size than heifers. Feed efficiency, on the other hand, goes down with increasing size of animals (figure 5) and the heifers decline in efficiency at a faster rate than bulls with increasing body size.

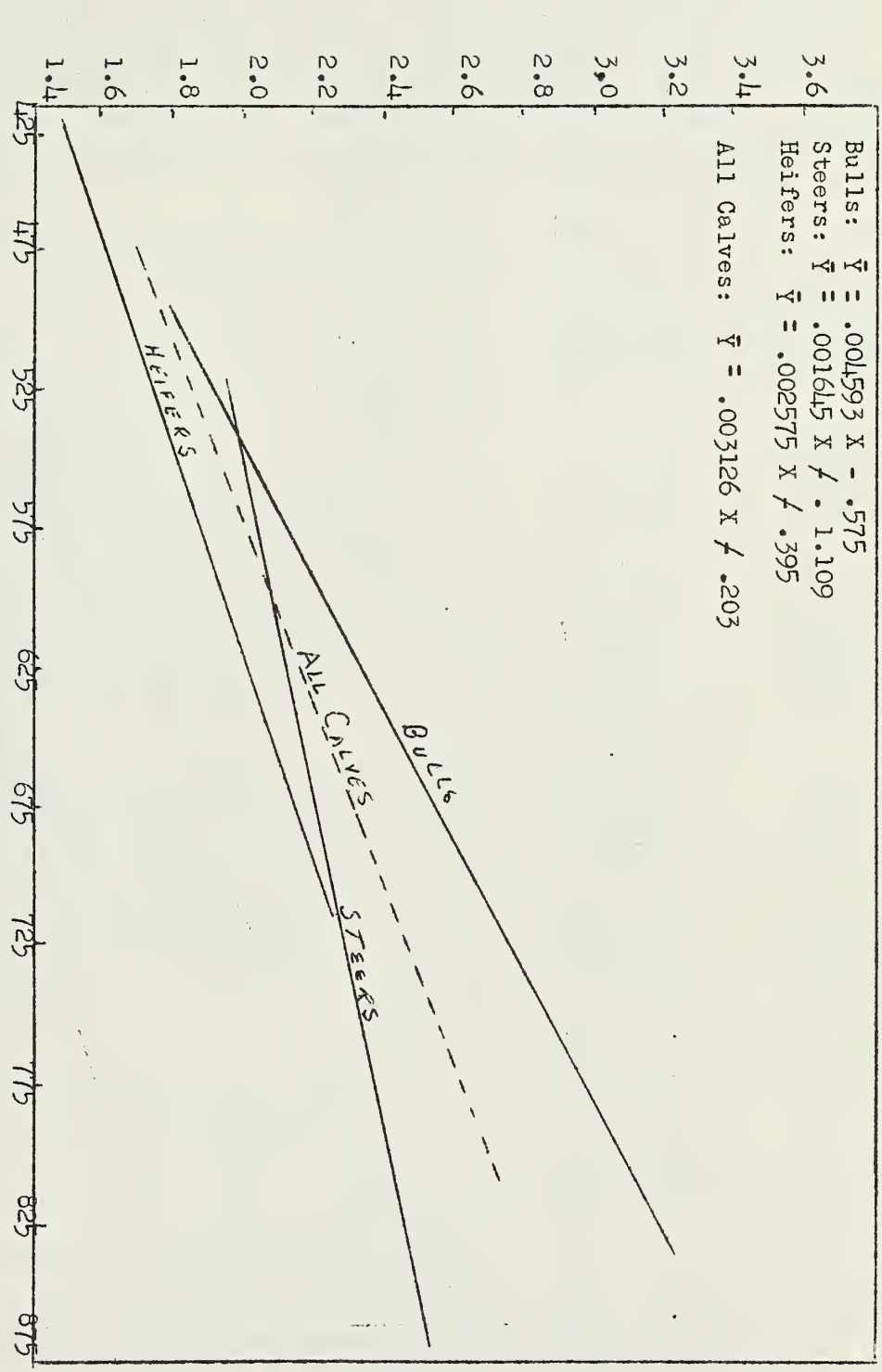

Figure 4. The regression of daily gain on live weight for bull, steer, and heifer calves.

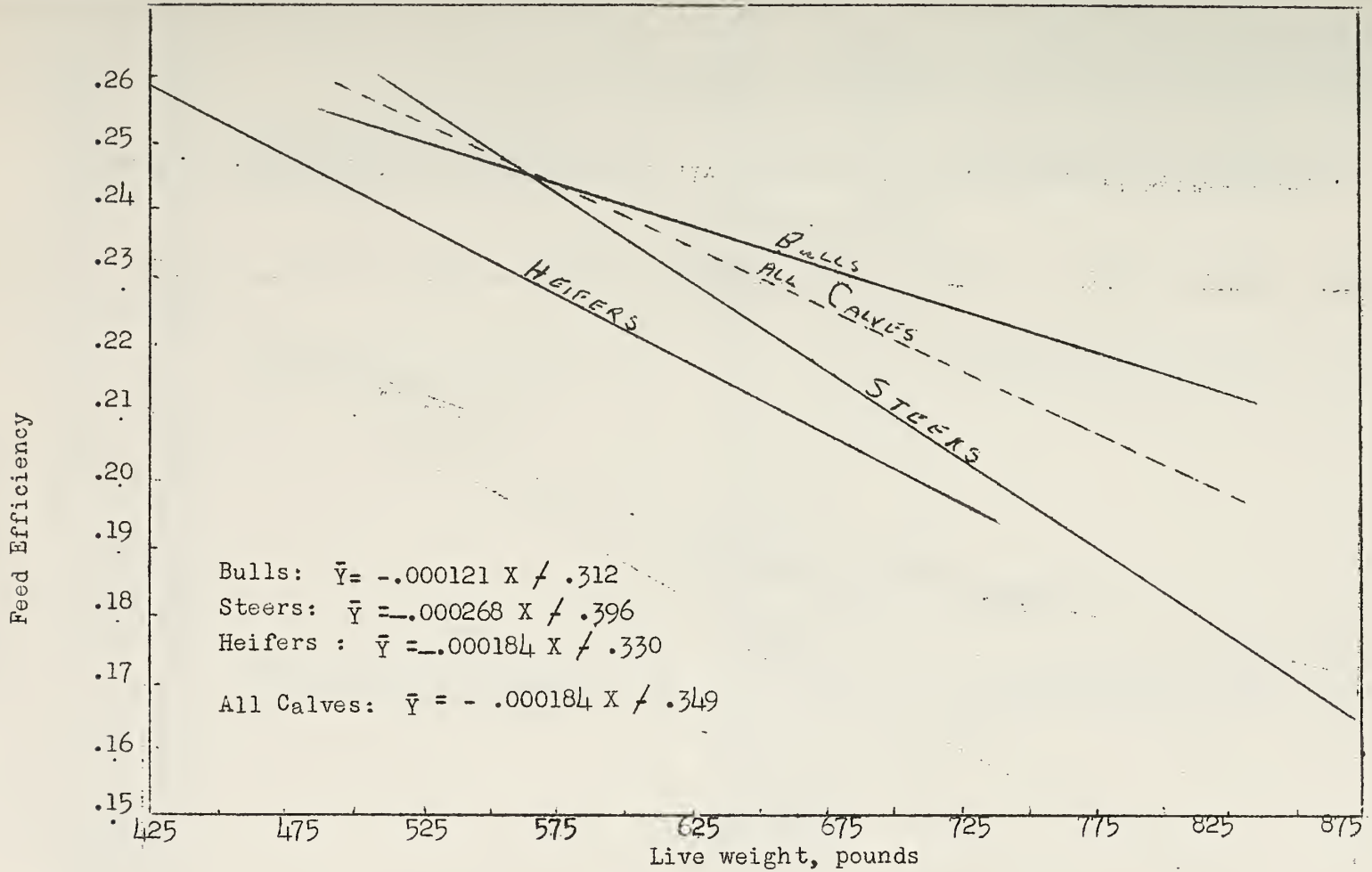

Figure 5. The regression of feed efficiency on live weight for bull, steers, and heifer calves.

Most live-animal scores and measurements showed little relation with feed efficiency and rate of gain (table 14) but conformation score at 500 lbs. was negatively related to both rate of gain and feed efficiency. Conformation score at 500 lbs. was highly related to conformation score at 800 lbs. live weight even though variations were greater among the judges doing the scoring than among the calves being scored. Apparently beef calves change in body shape and in the relationships of parts because ratios of measurements taken at 500 lbs. were not related to the same measurements taken at 800 lbs.

Table 14. Correlations Between Body Measurements, Conformation Score, Rate of Gain, and Feed Efficiency (Corvallis)

Items Correlated	Correlation Coefficient	Regression Coefficient
Wither height at 500 pounds:		
Age in days at 500 pounds	.313	.0126
Wither height at 800 pounds	.217	.1890
Feed efficiency from 500 to 800 pounds	.158	.0043
Rate of gain from 500 to 800 pounds	.410	.1210
Muscle-skeletal index at 500 pounds:		
Muscle-skeletal index at 800 pounds	.111	.1947
Feed efficiency from 500 to 800 pounds	-.060	-.0006
Rate of gain from 500 to 800 pounds	-.065	-.0059
Age at 500 pounds	.132	.0173
Paunch circumference at 500 pounds:		
Feed efficiency from 500 to 800 pounds	-.519*	-.0052
Rate of gain from 500 to 800 pounds	-.156	-.0021
Score at 500 pounds live weight with:		
Feed efficiency from 500 to 800 pounds	-.617*	-.0051
Rate of gain from 500 to 800 pounds	-.597*	-.0551
Score at 800 pounds	.587	.6160
Age at 500 pounds	.079	.0102
Heart girth at 500 pounds:		
Feed efficiency from 500 to 800 pounds	.226	.0043
Rate of gain from 500 to 800 pounds	.132	.0250

*Significant

Factors Affecting Rate and Economy of Gains

In a study of factors affecting rate and economy of gains during the test period, it was found that birth weight affects both rate and economy of gains with the heavier calves at birth gaining more per day and making more economical gains during the test period (tables 15 and 16). Also the age of the calf when put on test at 500 lbs. weight affected the rate of gain during test with older calves gaining more (table 15). Such factors as gains during the suckling period and weaning score were not found to be useful as indices of feedlot performance.

Table 15. Effect of Birth Weight (Pounds) and Age Put on Test (Days) on Rate of Gain During Test. (Corvallis)

Variate	Partial Regression coefficient	Standard deviation of b	95 percent confidence interval of b
Age put on test, days	0.0046	.001	.0028 to .0065
Birth weight, pounds	0.010	.004	.0022 to .0179

Table 16. Effect of Birth Weight (Pounds) on Economy of Gain During Test. (Corvallis)

Variate	Partial regression coefficient	Standard deviation of b	95 percent confidence interval of b
Birth weight, pounds	-2.096	0.7036	-0.675 to -3.518

In a physiological approach to factors associated with rate and efficiency of gain two major fields have been explored: the influence of certain hormones and the relation of constituents in the blood and urine to rate and economy of gains.

Influence of Male Hormones on Rate and Economy of Gains

Since the bulls gained faster and were more efficient feed converters than steers or heifers, it seemed possible that the male hormone might be involved. Several factors had to be considered in the use of the male hormone, testosterone. The amount of hormone which would be expected to bring about increased rate and economy of gains logically would be that amount secreted by the normal bull. This was estimated from the quantities excreted by the normal human male to be 1 mg. per kg. body wt. per week. Because of the danger that masculinizing by the male hormone might reduce carcass quality to such an extent that any increase in gains and economy might be offset by reduced carcass value, a non-masculinizing male hormone, methyl androstenediol, was also tried. Both hormones were injected intramuscularly at the rate of 1 mg. per kg. body weight per week during the period from 500 to 800 lbs. live weight.

Rate of gain was significantly increased by testosterone but methyl androstenediol had no effect on gains (tables 17 and 18). Feed efficiency was markedly improved by testosterone but again methyl androstenediol had no effect (tables 19 and 20). It is evident that testosterone had a more marked effect on the heifers than on the steers in improving both rate and economy of gains (tables 17, 18, 19 and 20).

Table 17. Effect of Male Hormones on Rate of Gain (Pounds Gain Per Day, 500-800 Pounds) (Corvallis)

	Treatments		
	Testosterone	Methyl Androstenediol	Control
Steers	2.68	2.22	2.39
Heifers	2.54	1.94	2.01
Average	2.61	2.08	2.20

Table 18. Effect of Male Hormones on Rate of Gain (Analysis of Variance) (Corvallis)

Source of Variance	d.f.	Mean Square	F.
Treatments	3	.3335	6.9**
Testosterone vs. other treatments	1	.9106	18.9**
Methyl androstenediol vs. controls	1	.0566	1.2
Control I vs. Control II	1	.0333	0.7
Sires	2	.1240	2.6
Sexes	1	.5296	11.0**
Error	17	.0482	

Table 19. Effect of Male Hormones on Feed Efficiency (Pounds TDN Required per 100 Pounds Gain) (Corvallis)

	Treatments		
	Testosterone	Methyl Androstenediol	Control
Steers	365	453	430
Heifers	393	501	507
Average	379	477	468

Table 20. Effect of Male Hormones on Feed Efficiency (Analysis of Variance) (Corvallis)

Source of Variance	d.f.	Mean Square	F.
Treatments	3	13,543	9.5**
Testosterone vs. other treatments	1	38,351	27.0**
Methyl androstenediol vs. controls	1	317	.2
Control I vs. Control II	1	1,907	1.4
Sires	2	1,560	1.1
Sexes	1	19,832	14.0**
Error	17	1,421	

The heifers receiving testosterone had a higher per cent of chuck than control heifers and both heifers and steers receiving testosterone had a higher per cent of round and a lower per cent of loin than control heifers and steers (table 21). Methyl androstenediol had no apparent effect on carcass quality.

Since there was some indication that the male hormone may have influenced the carcass as well as increasing rate and economy of gains, a second trial was conducted using 12 heifers and 12 steers, 6 of each sex receiving testosterone at the rate of 1 mg. per kg. body wt. per week while 6 of each sex acted as control. Methyl androstenediol was not studied since it seemed in previous studies to be without effect. In this second study rate and economy of gains, carcass cut-outs and measurements, chemistry of certain carcass cuts and cooking studies were all made.

The injection of testosterone increased rate of gain markedly in the heifers and to a less extent in the steers (table 22) during the period from 500 to 800 lbs. live weight. In the weight from 675 to 800 lbs. the testosterone had an even greater influence on rate of gain (table 23). This increased influence of testosterone as the trial continued is shown in table 24. It can be seen that rate of gain increased in the testosterone-treated calves, particularly the heifers as the experiment continued whereas the control calves showed little or no tendency to increase in gain per day.

Testosterone injections increased feed efficiency markedly in the heifers (saving of 119 lbs. TDN per 100 lbs. gain) and to a lesser extent in the steers (saving of 29 lbs. TDN per 100 lbs. gain) for the period from 500 to 800 lbs. live weight (table 25). During the latter part of the test period testosterone-treated heifers were again markedly more efficient than control heifers although both groups were less efficient than in the earlier part of the experiment (table 26). The testosterone-treated steers during this latter part of the trial were actually more efficient than control steers (table 26). This change in efficiency as the experiment continued is shown in table 27 for the heifers and steers in both the testosterone treatment and in the control groups.

It can be seen that the control and testosterone-treated heifers became less efficient as the experiment continued but that the difference between the two groups was maintained. The testosterone group of steers increased in efficiency as the experiment continued whereas the control steers became progressively less efficient (table 27).

The increase in rate of gain and feed efficiency resulting from injection of testosterone is not due to greater feed intake because the feed intake actually was slightly less for the calves receiving the male hormonesthan for the controls both for the overall period (table 28) and for the period from 675 to 800 lbs. live weight (table 29). Feed intake increased in all groups as the experiment progressed but it was slightly more for the control calves at all times (table 30). When feed efficiency was adjusted for differences due to rate of gain the testosterone-treated heifers and steers were still more efficient (table 31). Steers generally ate more per day than heifers (table 32) but their lower rate and economy of gains is not accounted for by their lower daily feed intake. Thus, testosterone must either alter maintenance costs, digestibility of feed, or the type of material laid down in the body. It seemed easier to study the carcasses for differences in material stored than to run metabolism studies on the live animals.

Table 21. The Effect of Male Hormones on Percentage of Wholesale Cuts of Beef Heifers and Steers (Corvallis)

Treatment	Ave. Live Wt. Lbs.	Dressing Yield	Round	Flank	Loin	Chuck	Rib	Plate	Brisket	Shank	Hind Quarter
					Percentage						
Heifers											
Testosterone		59.7	22.9*	6.27	20.77*	27.8*	8.75	6.85	3.13	3.53	50.0
Methyl androstenediol		58.3	20.9	5.93	23.57	25.1	8.46	8.16	4.43	3.26	50.4
Controls		61.1	20.1	6.18	24.58	25.5	8.34	7.86	3.78	3.06	50.9
Steers											
Testosterone		58.2	24.7*	4.82	19.61*	27.0	8.35	6.43	4.34	3.87	49.2
Methyl androstenediol		58.6	21.4	6.03	21.21	26.9	8.71	8.16	4.23	3.61	48.8
Controls		58.8	22.1	6.01	21.28	27.5	8.26	7.50	3.98	3.56	49.4
All Calves											
Testosterone	765.5	58.9	23.8*	5.55	20.20*	27.4	8.55	6.64	3.73	3.70	49.5
Methyl androstenediol	775.8	58.4	21.2	6.03	22.39	26.0	8.58	8.16	4.33	3.43	49.6
Controls	763.8	60.0	21.1	6.10	22.97	26.4	8.30	7.69	3.88	3.30	50.1

* Significantly different from other groups.

Table 22. The Effect of Testosterone on Average Daily Gains (Pounds) of Heifer ar Steer Calves.

Treatment Groups	Heifers	Steers
Testosterone	2.61	2.74
Control	2.09	2.65
Advantage of testosterone	0.52	0.09

Table 23. The Effect of Testosterone on Average Daily Gains (Pounds) of Heifer and Steer Calves During the Period from 675 to 800 Pounds Live Weight

Treatment Groups	Heifers	Steers
Testosterone	2.82	3.19
Control	2.26	2.80
Advantage of testosterone	0.56	0.39

Table 24. The Effect of Testosterone on Average Daily Gain (Pounds) of Heifer and Steer Calves.

Weeks after beginning of test	Treatment Groups			
	Control		Testosterone	
	Heifers	Steers	Heifers	Steers
2	1.93	2.57	2.38	1.98
4	1.79	2.27	2.29	1.91
6	1.74	2.36	2.10	2.45
8	1.96.	2.91	2.71	2.75
10	2.81	2.50	3.31	3.06
12	1.77	2.60	2.42	2.94
14	1.89	2.85	2.66	2.93

Table 25. The Effect of Testosterone on Total Digestible Nutrients (Pounds) Required per 100 Pounds Gain in the 1951-52 Trial.

Treatment groups	Sex Groups		
	Heifers	Steers	Both Sexes
Testosterone	379	369	
Control	498	398	374
Advantage of testosterone	119	29	448
			74

Table 26. The Effect of Testosterone on Total Digestible Nutrients (Pounds) Required per 100 Pounds Gain During the Period from 675 to 800 Pounds Live Weight.

Treatment Group	Heifers	Steers
Testosterone	404	354
Control	516	423
Advantage of testosterone	112	69

Table 27. The Effect of Testosterone on Total Digestible Nutrients (Pounds) Required per 100 Pounds Gain for Steer and Heifer Calves.

Weeks after beginning of test	Treatment Groups			
	Heifers		Steers	
	Control	Testosterone	Control	Testosterone
2	457	361	348	452
4	529	389	403	461
6	573	419	404	389
8	502	344	357	359
10	368	300	444	342
12	607	430	440	370
14	557	425	410	392

Table 28. The Effect of Testosterone on the Average Daily Intake on Total Digestible Nutrients of Heifer and Steer Calves During the Period from 500 to 800 Pounds Live Weight. (Corvallis)

Treatment Group	Feed Intake (TDN) Per Day	
	Heifers	Steers
Testesterone	9.89 lbs.	10.05 lbs.
Control	10.39 "	10.48 "
Control minus testosterone	0.50 "	0.43 "

Table 29. The Effect of Testosterone on the Average Daily Intake of Total Digestible Nutrients of Heifer and Steer Calves During the Period from 675 to 800 Pounds Live Weight. (Corvallis)

Treatment Group	Heifers	Steers
Testosterone	11.17 lbs.	11.26 lbs.
Control	11.63 "	11.81 "
Control minus testosterone	0.46 "	0.55 "

Table 30. The Effect of Testosterone on the Average Daily Intake of Total Digestible Nutrients of Heifers and Steers by Two-Week Periods, Showing Changes with Continued Treatment. (Corvallis)

Weeks after beginning of test	Treatment Groups			
	Heifers		Steers	
	Control	Testosterone	Control	Testoster
2	8.81 lbs.	8.60 lbs.	8.96 lbs.	8.94 l
4	9.45 "	8.90 "	9.16 "	8.78
6	9.97 "	8.78 "	9.51 "	9.53
8	9.86 "	9.32 "	10.37 "	9.88
10	10.33 "	9.94 "	11.11 "	10.46
12	10.76 "	10.39 "	11.41 "	10.88
14	10.52 "	11.28 "	11.67 "	11.48

Table 31. Effect of Testosterone on Feed Efficiency After Adjustment for Differences due to Rate of Gain (Pounds TDN Required per 100 Pounds Gain) (Corvallis)

	Treatments	
	Testosterone	Control
Steers	391.6	410.9
Heifers	388.0	452.9
Average	389.8	431.9

Table 32. Average Daily Intake of Total Digestible Nutrients of Heifer and Steer Calves (Corvallis)

Sex of Calves	Weight Gain Period	
	500-800 Pounds	675-800 Pound
Heifers	10.13	11.40
Steers	10.26	11.53

The testosterone-treated heifers and steers were lower in percent of hind quarter than controls. Likewise the testosterone-treated heifers and steers had a higher percent of chuck than the controls (table 33). There was a lowering in carcass grade due to the hormone treatment.

The testosterone treatment had little or no effect on evaporation loss during cooking on press fluid content of cooked roasts. There was less drip loss during cooking in the testosterone-treated heifers than in control heifers (table 33). Testosterone injections tended to make the steer beef considerably less tender whereas heifers receiving testosterone were more tender than control heifers (table 34).

Table 33. The Effect of Testosterone Treatment on Various Carcass Characteristics. (Corvallis)

	Heifers		Steers	
	Control	Testosterone	Control	Testosterone
Dressing percent	60.7	59.7	59.7	60.1
Percent of hindquarter	51.0	50.4	49.8	48.9
Percent of round	19.8	21.8	21.6	21.0
Percent of chuck	26.0	27.1	27.1	28.0
Percent of flesh to flesh-and-bone	85.3	83.6	83.1	83.2
Carcass grade	6 choice	3 choice 3 good	2 choice 4 good	1 choice 5 good

Table 34. The Effect of Testosterone and Sex on Evaporation and Drip Losses During Cooking, Press Fluid, and Shearing Strength of Meat Samples (Corvallis)

	Source of meat samples (treatment groups)			
	Heifers		Steers	
	Control	Testosterone	Control	Testosterone
Evaporation loss (percent) during cooking	8.1	9.7	8.9	9.7
Drip loss (percent) during cooking.	4.6	2.8	2.8	2.5
Press fluid of cooked meat (percent)	59.2	58.4	60.5	58.6
Shearing strength (pounds) required to shear 1" diameter core samples	13.4	12.3	9.9	15.5

There was a marked effect of testosterone injections on the chemical composition of meat samples, particularly in the heifers. In the meat samples taken, testosterone-treated calves showed less fat and more protein and water than control calves (table 35).

Table 35. The Effect of Testosterone Treatment and Sex Upon the Chemical Composition of Meat Sample of Experimental Calves (Corvallis)

Treatment Groups	Percent of Moisture	Dry Weight basis		
		Percent of fat	Percent of protein	Percent of ash
Control heifers	46.0	72.2	24.9	1.2
Testosterone-treated heifers	56.8	57.0	41.0	1.9
Control steers*	55.8	51.0	46.9	2.2
Testosterone-treated steers	50.5	47.4	49.6	3.0

*Averages based on four samples.

It would appear, then, that testosterone is increasing rate and economy of gains by increasing protein and water storage (growth) and reducing fat storage. Thus animals treated with testosterone approach the type of storage more typical of younger animals than is present in the controls. The questions relative to the effect of testosterone on maintenance costs and digestibility have not been answered but the concept is directed toward a change in kind of material stored.

The pituitary gland from each control and hormone-injected calf was used for bioassay for thyrotropin and gonadotropins by injecting the macerated pituitary material into male chicks over a 4-day period staring with day-old birds. Weight of the thyroid gland and testes of the assay birds were used to ascertain the potency of the pituitary gland for the two hormones.

Methyl androstenediol had little effect on the thyrotropic content of the pituitaries of beef calves as shown (table 36) by the weights of chick thyroids when birds were injected with pituitaries from control and methyl androstenediol injected calves. In sharp contrast to this, testosterone caused a marked increase in thyrotropic hormone content of calves (table 37 and 38). Steers in both the control and testosterone-treated groups had pituitaries containing more thyrotropin than pituitaries from control calves (tables 37 and 39).

Table 36. The Effect of Methyl Androstenediol Treatment on the Ability of the Anterior Pituitary Gland of Cattle to Produce Increase in the Weight of Chick Thyroid Glands (Average Weight of Chick Thyroid in Mg.). (Corvallis)

Source of pituitary tissue	Heifers	Steers
Control calves	3.52	4.40
Methyl androstenediol-treated calves	3.45	4.20

Table 37. The Effect of Testosterone Treatment on the Ability of the Anterior Pituitary Gland of Calves to Produce Increases in Weight of the Thyroid Glands of Baby Chicks. (Corvallis)

Source of pituitary material	1950-51 Trial	1951-52 Trial
	Average weight of thyroids in mgs.	
None	3.04	2.83
Control heifer calves	3.52	3.81
Testosterone-treated heifer calves	4.24	4.46
Control steer calves	4.40	4.10
Testosterone-treated steer calves	4.99	4.87

Table 38. Analysis of Variance of the Effect of Testosterone and Methyl Androstenediol Treatments Upon the Ability of the Anterior Pituitary Gland of Calves to Produce Increases in the Weights of Baby Chick Thyroid Glands. (Corvallis)

Source of Variation	Degrees of Freedom	Mean Square	F.
Replications	5	46.13	24.49*
Treatments	2	20.58	10.92*
Testosterone vs. other treatments	1	39.90	21.18*
Methyl androstenediol vs. controls	1	1.24	.67
Levels of injection	2	16.57	8.79*
Error	419	1.88	

*Indicates statistical significance at .05

Table 39. Analysis of Variance of the Effect of Testosterone Treatment, Sex of Calf and Level of Anterior Pituitary Injection on the Ability of the Anterior Pituitary Gland of Calves in the 1951-52 Trial to Produce Increases in the Weight of Baby Chick Thyroid Glands. (Corvallis)

Source of Variation	Degrees of Freedom	Mean Square	F.
Replications	5	28.49	76.72*
Sex	1	12.81	7.52*
Treatments	1	53.91	31.63*
Level	2	20.54	12.05*
Error	419	1.70	

*Indicates statistical significance at .05.

Table 40. The Effect of Testosterone on Feed-Lot Performance and Thyroid Activity of Beef Heifers and Steers. (Corvallis)

Treatment Group	Total digestible nutrients consumer (lbs.) Per day	Per lb. gain	Average daily gain (pounds)	Wt. of thyroid gland (gms.)	Survival time of assay mice (min.)
Control heifers	10.39	4.98	2.09	16.3	43.2
Testosterone treated heifers	9.89	3.79*	2.61*	19.4*	48.1*
Control steers	10.48	3.98	2.65	17.2	45.6
Testosterone treated steers	10.05	3.69*	2.74*	19.6*	48.4*

*Indicates a significant difference from corresponding control (.05 level)

The thyroxine content of the thyroids was tested by injecting macerated thyroid gland material into mice that had been previously fed 0.1% thiouracil in

their diet and observing the effect of thyroid gland tissue from control and testosterone-treated calves on survival time of mice when sealed in one-half pint jars. It was found that injecting thyroid material from control animals shortened survival time of mice to a greater extent than thyroid material from testosterone-treated calves. Thus the thyroids from control calves had a higher thyroxine content than thyroids from testosterone-treated calves (tables 40 and 41).

Table 41. The Effect of Testosterone Treatment Upon the Ability of Thyroid Gland Tissue from Experimental Calves to Decrease the Time Required for Asphyxiation of Thiouracil-Treated Mice. (Corvallis)

Source of thyroid gland tissue	Sex of mice used		
	Male	Female	All mice
	Survival time (minutes)		
Heifers	33.6	50.4	43.2
Control	36.0	57.1	48.1
Testosterone			
Steers			
Control	35.3	53.3	45.6
Testosterone	37.0	56.9	48.4

The histology of thyroid glands from control and testosterone-treated calves showed greater epithelial height and less colloid in the glands from the calves receiving testosterone (figure 5). This observation along with the greater thyrotropic activity of pituitaries of calves receiving testosterone indicate that the greater rate of gain, more efficient conversion of feed into meat, greater water and protein storage with lessened fat deposition are all related to a slight hyper-thyroidism created by injecting testosterone. It does not preclude the possibility that testosterone and thyroxine might have similar effects on metabolism.

The effect of testosterone injections on the gonadotropic hormone content of the pituitary was not clear-cut because in one year there appeared to be a greater gonadotropic potency of pituitaries from calves injected with testosterone whereas in the other year pituitaries from calves treated with testosterone were definitely lower in gonadotropic potency.

There was evidence, however, that testosterone injection in heifer calves markedly reduced the LH fraction of the gonadotropins in the pituitaries but that methyl androstenediol had no such effects (tables 42 and 43).

Table 42. The Effect of Methyl Androstenediol and Testosterone Treatments on the Ovaries of Heifer Calves in the 1950-51 Trial (Corvallis)

	Control	Testosterone	Methyl Androstenediol
Percent of heifers with ovaries showing recent corpus lutea	100	0	100
Average ovarian weight--grams	10.6	7.0	11.7
Average diameter of largest follicle (mm)	9.0	13.3	10.6

Table 43. The Effect of Testosterone on the Ovaries of Heifer Calves in the 1951-52 Trial. (Corvallis)

	Control	Testosterone
Percent of heifers with ovaries showing recent corpus lutea	100	33
Average ovarian weight (gm.)	10.9	10.2
Average diameter of largest follicle (mm)	12	14
Average number of follicles over 4 mm diameter (per calf)	7	3

The methyl androstenediol had little or no effect on penis or accessory glands in the male whereas the testosterone produced effects equal to the normal male. Masculinity was stimulated in both the steers and the heifers to the extent that a crest developed. Heifers receiving testosterone came into violent heat and apparently were in heat for longer periods of time than normal.

The other physiological approach to studies on growth and feed efficiency had involved a chemical determination of constituents of the blood and urine on fast and slow gaining calves, heart rate and body temperature on calves varying in rate and efficiency, and chemical determination of constituents of the blood and urine of rabbits varying a great deal in adult body size.

Urea, ammonia, creatinine, creatine, uric acid, and total nitrogen were determined on the urine of all calves feed-tested at the Central Station in 1952-53 both at the 500 and at the 800 lbs. weight. Haemoglobin, glucose, amino acid N, creatinine, creatine, urea and uric acid were determined on the blood of calves feed-tested at the Central Station during the 1952-53 season both at the 500 lb. and at the 800-lb. weights. Only the data on blood glucose and amino acid nitrogen have been analyzed to date. Blood glucose was 58.15 mg. per 100 ml. in calves at 500 lbs. and 67.42 mg. per 100 ml. in calves at 800 lbs and this increase in blood glucose with increased size of calf was true for all groups. It appears that as calves become larger there is more glucose available in the blood stream for conversion to and storage as fat. There was no relation of blood glucose level to either rate or economy of gains. Blood amino acid nitrogen averaged 6.99 mg. per 100 ml. for calves at 500 lbs. and 7.10 mg. per 100 ml. for calves at 800 lbs. Thus blood amino acid nitrogen varied very little with increasing size of the calf. There was a variation in blood amino acid nitrogen between breeds and between sexes with the faster gaining groups showing lower blood levels. Thus it appears that in the better doing animals the amino acid nitrogen was being removed from the blood stream for the building of new tissue (growth).

The same determinations were made on the blood and urine of rabbits varying greatly in adult body size both during their growth period and at maturity. Blood amino acid nitrogen and glucose data have been analyzed. Polish, a very small breed, had 9.4 mg. of amino acid nitrogen per 100 ml. blood for males and 9.3 mg. per 100 ml. for females as contrasted with New Zealand White, an intermediate breed, in which the males had 8.8 mg. per 100 ml. and the females had 8.4 mg. amino acid nitrogen per 100 ml. bloods.

Blood glucose values were 113 mg. per 100 ml. blood in Polish males, 96 mg. per 100 ml. blood for Polish females, 104 mg. per 100 ml. for New Zealand males and 94 mg. per 100 ml. blood for New Zealand females. Males were generally higher than females and Polish were generally higher than New Zealand White rabbits in blood glucose values. Males are generally smaller than females and Polish rabbits are definitely smaller than New Zealands, but whether adult size and blood glucose values are related has not been proven.

In a study of rectal temperatures it was found that diurnal rhythm exists with a more constant level at 10 a.m. to 12 noon. Temperatures taken at this more constant time of day on calves at weekly intervals between 500 and 800 lbs. weight showed that bulls are generally higher in body temperature than heifers (table 44).

Table 44. Rectal Temperatures and Rates of Gain of Beef Calves (Corvallis)

	Hereford		Angus	
	Heifers	Bulls	Heifers	Bulls
Mean* Temp.	101.73	101.89	101.69	101.90
Std.* Dev.	.467	.564	.373	.54
Lbs/day Gain	2.27	2.92	1.89	2.87

There was a significant regression of rectal temperature on body weight with the heifers starting at a lower body temperature and declining at a more rapid rate than bulls (table 45). Since bulls gain more rapidly, have a higher body temperatu

Table 45. Regression of Rectal Temperature on Body Weight (Corvallis)

Source of Variation	d.f.	F.	Increased Temperature/100 lbs. body weight
Hereford heifers	202	47.80**	-.212°F
Angus heifers	168	23.28**	-.139°F
Hereford bulls	136	5.25*	-.093°F
Angus bulls	71	.11	-.020°F

** Significant at the 1% level
* Significant at the 5% level

and decrease in body temperature at a less rapid rate with increasing weight, it seemed that rectal temperature might be related to rate and economy of gains. Only in the case of the Angus bulls was such a relationship evident (table 46); therefore, rectal temperature could not be used as an index of rate and economy of gains though it is definitely related to metabolism.

Table 46. Regression of Average Rectal Temperature on Average Rate of Gain(Corvallis)

Source of Variation	d.f.	F.
Hereford heifers	11	.09
Angus heifers	7	5.59 (sig. at
Hereford bulls	9	3.33 5% level)
Angus bulls	4	.02

One phase of work which is being done but the results are not ready yet is that of doing "paper" selection and then studying the production of the offspring of the "selected" population with that of the population from which they were selected. This study is being made on a mass of data accumulated over a 10-year period at the Squar Butte-Harney Station.

Small animals are being used in every way possible to speed up getting results on the beef cattle. Several studies may yield information of value to us with our larger animals. The Oregon Station has recently acquired a good small animal laboratory where work of a higher caliber can be done.

Extension Staff Cooperates - Oregon has been fortunate in having an active and cooperative Extension Service which has helped the breeders to employ the knowledge developed by researchers in the entire region. Work on the dwarf problem in which animals are profiled and keyed as a means of helping the breeder to select against dwarfism is being done by J. T. Elings, Extension Specialist and two County Agents - Wm. Farrell and Les Marks, three of our extension people who first were trained in taking profiles and in keying them out. Also the bull testing that is done by breeders in Gilliam County with the help and guidance of their able County Agent Ernest J. Kirsch, has stimulated ranchers in Oregon to feed-test or to at least keep weight records on the cattle on the home ranch. Guidance by John Landers, Jr., H. A. Lindgren and J. T. Elings, all Animal Husbandry Extension Specialists is always available to farmers who wish to performance-test their beef cattle. The Extension people are in front in putting this program across.

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I. Cattle Inventory

A. Purebreds

BEEF BREEDING PROJECT SUMMARY
Fiscal Year 1952-53

State Oregon

Date

Line designation	Lionheart	Prince	David	Angus	Union Hereford							
Breed	Hereford	Hereford	Hereford	Angus								
Station	Central	Central	Central	Central	Union							
Bulls (12 mo. or over)	2	2	1	3	3							
Cows (2 yrs. or over)	14	12	12	17	27							
Heifers, yearlings	8	9	9	10	7							
Male calves	3	10	7	8	12							
Heifer calves	7	5	3	9	12							
Percentage use for Breeding project	50				100							
Estimated cash value	16,000	12,200	10,700	18,200	23,000							

B. Grades

Line designation												
Breed												
Station		Union	Squaw Butte									
Bulls (12 mo. or over)		4	2									
Cows (2 yrs. or over)		80	30									
Heifers, yearlings			28									
Male calves		35	13									
Heifer calves		35	13									
Percentage use for breeding project		20	100									
Estimated cash value		23,250	13,450									

II. Young animals which were on feed during 1952-53.

A. Purebreds

	Herefords		Angus		Shorthorns	
	Number Individually Fed	Number Group Fed	Number Individually Fed	Number Group Fed	Number Individually Fed	Number Group Fed
Bulls	21	0	6	0	0	0
Heifers	24	0	11	0	0	0
Steers	0	0	0	0	0	0

B. Grades

Bulls	0	0	0	0	0	0
Heifers	28	0	0	0	0	0
Steers	0	60	0	0	0	0

IV. Funds expended during fiscal year 1952-53 (Make estimates for remainder of year)

Source	Amount Non-recurring items	Amount Operating Expense		
9 b3		$8,300		
BAI funds		3,600		
State-controlled funds	$3,000 barn at Burns 3,000 Angus bull	Union $7,000	Squaw Butte $5,000	Central $15,000

III. Additions of land, physical facilities and equipment during fiscal year 1952-53.

Item	No.	Actual Cash Value	Percentage use for beef breeding project	Remarks
Corvallis Small Animal Lab	1	$10,000	1/3	Used jointly for nutrition, reproduction physiology and range
Burns Barn	1	6,000	1/2	

W-1 Technical Committee Report
U. S. Range Livestock Experiment Station
Miles City, Montana

Accomplishments 1952-53

Analyses of data covering ten years of progency studies (1942-51) were completed during the year. Included in the study were 635 steers. The data were analyzed, having as a primary objective the determination of the effect of selection for growth factors upon carcass quality.

Correlations between the following factors were computed: birth weight, weaning weight, average daily gain and efficiency of gain during a time-constant feeding period, final weight off feed, slaughter grade (made just prior to killing), shipping shrink, dressing percentage, carcass grade, area of eye muscle, thickness of fat over the eye muscle, color of lean, and the carcass measurements of length of body and length of leg.

Growth prior to weaning and growth after weaning were found to be significantly correlated. Birth weight was related to subsequent growth more highly than was weaning weight. Both factors were positively associated with carcass quality.

Relationships between efficiency of gain during the feeding period and the other factors studied were generally low. Rate and efficiency of gain were significantly correlated. There was a negative correlation between efficiency of gain and dressing percentage, which may have been due to the degree of fatness of the more efficient steers. Final weight and average daily gain were positively correlated with most of the desirable carcass characteristics. There did tend to be a negative relationship between growth and degree of external fat on the carcass. This is not necessarily antagonistic to a desirable carcass unless external fat is closely related to amount of internal fat.

Live animal appraisal prior to slaughter did not serve as an accurate indication of either carcass grade or dressing percentage. Grades were a better indication of degree of external fat than they were of size of the eye muscle, a more desirable characteristic.

Shrinkage of the steers in transit between Miles City, Montana, and South St.Paul, Minnesota, ranged from a high of 6 percent to a low of 2 percent during the ten years. The mean shrink for the ten years was 3.8 percent.

In general, there were positive relationships between ability to make rapid growth and a desirable carcass. Present selection procedures involving selection for improved rate and efficiency of gain should result in some improvement in carcass quality.

Bull calves were production tested this year for the first time from line 11. Line 11 was founded at the station from a reciprocal cross between lines 1 x 5. The bull calves were from line 1 x 5 heifers back-crossed to a line 1 sire. Their average daily gain during the time-constant testing period was the highest of any line this year.

Calves from a line 1 x 10 cross were also tested this year. At weaning, these calves, all of which were raised by line 1 cows, averaged 40 pounds heavier than the mean weaning weight of three line 1 sub-lines. However, they were not superior in the feed lot, probably due to a high incidence of feed lot disorders.

The blood sampling phase of a cooperative grazing experiment involving the U. S. Range Livestock Experiment Station, the Montana Agricultural Experiment Station, and the U. S. Forest Service, was concluded this year. Samples were analyzed for carotene, vitamin A, Calcium, phosphorus and magnesium at 28-day intervals throughout the course of the experiment. Complete analyses of the study will be made during the following year but present indications are that the blood levels were generally adequate throughout the year for all five blood constituents.

Present Status

This year the line herds were established as follows:

Line 1 - composed of five sub-lines. New sires in two sub-lines are to be selected on the basis of progeny tests and three on the basis of sib tests.

Line 4 - composed of two sub-lines.

Line 5 - reduced from two sub-lines to a single herd in an effort to improve fertility within the line.

Line 6 - one herd.

Line 7 - one herd.

Line 8 - one herd.

Line 9 - one herd.

Line 10 - one herd.

Line 11 - one herd.

Future Plans

Line 7 will be sold this year as it is now evident that it offers little promise of developing into a productive line. An effort will be made to sample another herd for the establishment of a new line. Consideration will be given to the purchase of the new line from a herd that is presently being production tested in the field.

Results of the carcass appraisals indicate the need for continued carcass research in conjunction with present selection procedures.

I. Cattle Inventory

A. Purebreds

BEEF BREEDING PROJECT SUMMARY

Fiscall Year 1952-53

Station ~~Miles City~~

Date July 8, 1953

Line designation	L1	L4	L5	L6	L7	L8	L9	L10	L11	Others		
Breed	Hereford											
Station	US Range											
Bulls(12 mo.or over)	14	3	1	1	3	1	2	3				28
Cows(2 yrs. or over)	176	40	40	27	34	18	29	29	14			407
Heifers,yearlings	56	11	17	7	10	6	12	6	7	9		135
Male calves	55	12	17	9	9	8	7	9	8			134
Heifer calves	75	17	11	6	3	5	15	11	3			146
Percentage use for Breeding project	100	100	100	100	100	100	100	100	100	0		
Estimated cash value	$97,175	$22,100	$30,000	$12,400	$15,000	$10,500	$16,000	$14,800	$10,000	900		

B. Grades

Line designation	Grade	Coop Experiment										
Breed	Hereford											
Station	US Range											
Bulls(12 mo. or over)	0	0										
Cows(2 yrs. or over)	234	78										312
Heifers, yearlings	132	*										132
Male calves	103	28										131
Heifer calves	100	25										125
Percentage use for breeding project	100	0										
Estimated cash value	$66,150	$20,000										

* Included in grades

850

700

1551

II. Young animals which were on feed during 1952-53.

A. Purebreds

	Herefords		Angus		Shorthorns	
	Number Individually Fed	Number Group Fed	Number Individually Fed	Number Group Fed	Number Individually Fed	Number Group Fed
Bulls	77					
Heifers	0	144				
Steers	0	57				

B. Grades

	Hereford X Angus					
Bulls	0	0				
Heifers	0	99		34		
Steers	0	115		31		

IV. Funds expended during fiscal year 1952-53 (make estimates for remainder of year)

Source	Amount Non-recurring items	Amount Operating Expense
BAI funds		$50,522.50
State-controlled funds		$87,133.10

Livestock Inventory - July 1, 1953

A. Purebreds

Line designation	1	2	3
Breed	Hereford	Hereford	Shorthorn
Station	Utah	Utah	Utah
Bulls (12 mo. or over)	6	6	8
Cows (2 yrs. or over)	22	32	32
Heifers, yearlings	9	9	9
Male calves	9	11	13
Heifer calves	9	16	12
Percentage use for breeding project	100	85	85
Estimated cash value	$ 8900	$11,575	$12,025

The beef cattle breeding project is progressing according to the original plan. Development of the two Hereford and one Shorthorn lines is being continued. During the year the facilities at the Panguitch sub-station were largely made available for use by the beef project. This will enable the size of the Hereford lines to be increased.

Individual feeding tests were carried out with 11 Hereford bulls and 7 Hereford heifers and 6 Shorthorn bulls and 5 Shorthorn heifers in the 1952-53 season. In addition, 7 Hereford steers and 6 Shorthorn steers were used in group feeding trials.

The various phases of the project that have been emphasized during the year are as follows:

(1) Analysis of data that has been accumulated.
(2) Further study of the use of an all pelleted ration for feeding trials.
(3) Dwarfism
(4) Anti-pyrine

The progress on the above topics will be given in the order in which they are listed.

Analysis of data

At the Utah station the calves in the project have been handled in a standard manner from 1948 through 1952. During this period 124 head of calves, representing nearly all the living offspring from 9 sires (6 Hereford and 3 Shorthorns) were put through the standard individual feeding test. The heifers, as well as the bulls, were studied. The data were analyzed according to the method described by Hazel (1946). The results of the 3 analyses are shown for rate and efficiency of gain in tables 1 and 2, respectively.

As can be seen from table 1, the sire and sex influence were significant while age of dam and initial weight did not significantly affect rate of gain.

Analysis for efficiency of gain is shown in table 2..

This analysis shows that efficiency of gain is influenced by sire, sex, and initial weight but the age of dam influence was not significant.

Table I. Effect of sire, sex, age of dam, and initial weight upon the rate of gain during feeding period

Source	d.f.	Mean Sqs.	F
Sires	8	0.2097	2.47*
Sex, adjusted for all other effects	1	9.8169	115.7653**
Age of dam, adjusted for all other effects	1	0.1239	1.4610
Initial weight, adjusted for all other effects	1	0.0084	0.0990
Error	112	0.0848	

Estimated effects:

Fixed effect	= 1.77	Sex(Male)	- 0.66
Sire 1	= -0.26	Sex(Female)	= 0.00
Sire 2	= -0.24	Age of dam	= 0.01
Sire 3	= -0.12	Initial Wt.	= 0.00
Sire 4	= -0.01		
Sire 5	= -0.27		
Sire 6	= 0.20		
Sire 7	= -0.25		
Sire 8	= -0.12		
Sire 9	= 0.00		

* Significant at the .05 level
** Highly significant at the .01 level

All Pelleted Ration

In 1951 a report was made on a study in which an all pelleted ration was compared with a long hay and grain ration. No difference in rate and efficiency of gains were found in this study. The animals on the all pelleted ration, however, seemed to crave roughage and ate considerable quantities of wheat straw bedding.

In 1952 another trial was run with heifer calves comparing an all pelleted ration with a long hay and grain ration. Wood shavings were used as bedding in this trial to prevent the calves from eating the bedding. An analysis of the data again showed no significant difference in rate and efficiency of gains. The calves on the long hay and grain showed slightly higher average daily gains but the difference was not statistically significant.

Some trouble with bloat was experienced among the calves fed the all pelleted ration. No losses occurred and the gains were not adversely affected, apparently, but extra attention had to be given. Some calves would undoubtedly have died if treatment had not been given.

The pellets used in this trial contained 2 parts of concentrates to one part of alfalfa. The alfalfa was ground as coarsely as possible for pellet making. It is possible that adjusting the concentrate mixture or replacing part of the alfalfa with some other roughage might be effective in reducing the bloat danger.

Table II. Effect of sire, sex, age of dam, and initial weight upon the efficiency of gain during the feeding period.

Source	d.f.	Mean Sqs.	F
Sires	8	25.714	5.11*
Sex, adjusted for all other effects	1	4854.107	963.69**
Age of dam, adjusted for all other effects	1	10.745	2.13
Initial weight, adjusted for all other effects	1	200.623	39.8298**
Error	112	5.037	

Estimated effects:

Fixed effect	= 27.75	Sex (Male)	= 4.63
Sire 1	= - 3.42	Sex (Female)	= 0.00
Sire 2	= - 0.60	Age of dam	= 0.11
Sire 3	= 0.14	Initial Wt.	= -0.02
Sire 4	= - 0.47		
Sire 5	= 0.70		
Sire 6	= 4.38		
Sire 7	= -2.36		
Sire 8	= -0.74		
Sire 9	= 0.00		

* Significant at the .05 level
** Highly significant at the .01 level

Dwarfism

In line 2 Herefords considerable trouble with dwarfism occurred. As aids in reducing dwarfism in this line heterozygous cows have been retained to serve as a tester group for testing prospective sires and profilometer readings have been made on possible sires. This year only bulls that appear free of the dwarf gene by either the profile reading or by a breeding test are being used. In 1952 a bull that had given an indefinite profile reading was used. Four dwarf calves (three heifers and one bull) were produced. These calves were studied in order to gain information that would add to the knowledge concerning dwarfism. Birth weights and measurements were taken on all calves. A comparison of the dwarf heifer calves and the normal Hereford calves' measurements is given in table 3.

Table III. Comparative measurements of normal and dwarf Hereford heifer calves

	Normal	Dwarf(3)	Difference
Birth Wt.	68.86 ± 1.9 lbs.	49.33 ± 0.620 lbs.	19.53 lbs.**
Ht. withers	24.80 ± 0.223 in.	20.43 ± 0.061 in.	4.37 in.**
Ht. hips	26.34 ± 0.274 In.	21.97 ± 0.096 in.	4.37 in.**
Depth chest	10.18 ± 0.098 in.	9.03 ± 0.061 in.	1.15 in.**
Head length	8.70 ± 0.098 in.	8.13 ± 0.010 in.	0.57 in.*
Head width	4.41 ± 0.078 in.	4.53 ± 0.018 in.	0.12 in.**
Length foreleg	15.82 ± 0.224 in.	12.90 ± 0.163 in.	2.92 in.**
Heart girth	27.86 ± 0.104 in.	24.53 ± 0.331 in.	3.33 in.**
Profile score	2.43 ± 0.168	1.33 ± 0.085	1.10*
Forehead bulge	1.86 ± 0.198	4.33 ± 0.085	-2.47**
Eye bulge	2.86 ± 0.091	1.00 ± 0.000	1.86**
Body conformation	3.29 ± 0.213	1.00 ± 0.000	2.29**
Round conformation	3.14 ± 0.171	2.67 ± 0.085	0.47
Condition	3.07 ± 0.214	2.67 ± 0.085	0.40
Jaw formation	2.43 ± 0.167	1.67 ± 0.085	0.76
Head length/width	1.97 ± 0.032	1.79 ± 0.006	0.18**
Ht. withers/chest	2.44 ± 0.002	2.27 ± 0.010	0.17**

* Significant at the .05 level
** Significant at the .01 level

During the spring months staff members at the Utah station became interested in the possible application of paper chromatography to large animal genetic investigations. Paper chromatography for use in the study of metabolic patterns has been very successful. There is a strong possibility that chromatography might provide a very inexpensive means of identifying heterozygous, dwarf, and normal calves. It may be possible, also, to identify the rapid gainers, or the most efficient animal through paper chromatography.

Some preliminary chromatography studies of dwarf and normal calveshave been made and the results indicate that this tool is worthy of further detailed investigation. The potentials of this method of chemical determination are tremendous for biological research. It is planned to continue these studies at the Utah station.

Antipyrene

The use of antipyrene for determining percentage fat in live animals has demonstrated definite possibilities. Trials at the Utah station in 1952 showed that irregularities in the readings frequently occurred when the procedure reported in the literature was followed. Further tests will be run during the summer months in an effort to improve and standardize the technique in an effort to obtain a means of accurately measuring fat percentage in live cattle.

Expenditures

Expenditures July 1, 1952 to July 1, 1953

Source	Amount
10b	$ 2,400.00
9b1 and 9b2	4,140.46
9b3	7,856.66
State and sales	14,126.96
	$ 28,524.08

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STATE COLLEGE OF WASHINGTON
Department of Animal Husbandry
Pullman, Washington

1 & 2

RAISING CALVES FROM BIRTH ON SYNTHETIC AND RECONSTITUTED MILK

by
M. W. Galgan and M. E. Ensminger

This project was born of necessity--the necessity to eliminate an infection of Johne's disease[3] in the beef cattle herd at the State College of Washington. Because of the extreme susceptibility of young calves to this disease, it seemed highly desirable that they be raised in strict isolation from birth, apart from their dams. Simultaneously, a test and slaughter and/or isolation program was initiated in the older animals in order to eliminate the Johne's disease as rapidly as possible.

Raising calves from birth without their dams also afforded an excellent opportunity to study many other pertinent problems. Thus, the following objectives exist:

1. To raise calves from birth without their dams as a means of eliminating a contagious disease that is transmitted from dam to offspring.
2. To production test from birth, in an effort to evolve a satisfactory efficiency-of-feed-utilization-test for beef calves at an early age, thus alleviating the considerable time and expense involved in present tests (commonly 7 to 12 months of age).
3. To compare dried whole milk with synthetic milk.
4. To evaluate the use of antibiotics (terramycin) in the promoting growth and feed efficiency of calves.

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[1]The Johne's disease control phases of this project were developed and carried out in cooperation with the College of Veterinary Medicine, State College of Washington. Special acknowledgement is made of the splendid cooperation extended by Dr. F. K. Bracken, D.V.M. Also, special acknowledgement is made of the faithful services rendered by the Beef Cattle Herdsmen--Messrs. Dave Foster and Ed Hanks--without whose dependable help this project, especially in the disease control phases, could not have been successful. Miss Mary Ann Cipolloni and Mr. Warren North, Experimental Aide and Animal Husbandry student, respectively, summarized the data. The valuable counsel and advice of Dr. T. H. Blosser, Dairy Science Department, State College of Washington and Dr. E. M. Gildow, Carnation Farm, Carnation, Washington, is also acknowledged.

[2]Acknowledgement is herewith made of and grateful appreciation is expressed for the following gratis contributions to this project: the synthetic milk and the terramycin provided by the Chas. Pfizer Co., Inc., Brooklyn, New York: 40 tons of dry skim milk (for use after six months of age) provided by the Commodity Credit Corporation; and the bottles and nipples provided by Albers Milling Company, Los Angeles, California.

[3]Johne's disease was first diagnosed in one animal (a 9 year old cow) in March, 1952. Subsequent herd tests, at 90-day intervals, revealed 20 additional reactors all of which were slaughtered.

In addition to the primary objectives set forth above, many practical beef cattle producers have expressed interest in the project from the standpoints of (1) evaluation of "synthetic milk" as a substitute for nurse cows and (2) a means of raising orphaned calves and calves from very young or very old cows.

Experimental Design

Dried Whole Milk				Synthetic Milk			
With Terramycin		Without Terramycin		With Terramycin		Without Terramycin	
Male	Female	Male	Female	Male	Female	Male	Female

Calves were assigned at random to the sex groups indicated.

Each animal is stabled in an individual pen, and is fed separately.

Animals and Rations

All calves were taken from their dams at birth[1], thoroughly scrubbed and disinfected in the laboratory, and placed under heat lamps to dry.

During the first two days of life, each calf received colostrum.[2] Beginning with the third day and continuing until 30 days of age, the calves were fed milk either reconstituted dried whole milk or synthetic milk[3] in one-half gallon bottles equipped with rubber nipples, in keeping with the experimental design indicated. Milk feeding was at the rate of 1 lb. of reconstituted (Reconstituted by adding water until solids equal 13% by weight) milk per 10 lbs. of body weight of calf.

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[1] None of the calves ever nursed their dams; in fact, most calves were caught in the arms of the herdsmen.

[2] Colostrum had been obtained from nearby dairies and frozen and stored until needed. Before feeding, it was warned to body temperature. The calves were given colostrum only for the first two days following birth. Then on the third and fourth days of age, colostrum was mixed with reconstituted dry whole milk or synthetic milk, respectively, in order to minimize digestible disturbances while making the transition.

[3] The formula of the synthetic milk is as follows:

Ingredient	Pounds
Dried skim milk	78.0
Fish solubles	5.0
Corn steep liquor	0.125
Molasses	0.125
Lard	9.00
Dried brewers' yeast,	1.5
Lecithin	4.0
Vitamin pre-mix 1	2.05
	99.800

TABLE I

Rate and Efficiency of Gain of Calves Fed Dried Whole Milk Vs. Synthetic Milk, Each With and Without Terramycin[1]

Whole Milk						Whole Milk + Terramycin					
Male			Female			Male			Female		
Calf No.	Rate of Gain	Efficiency	Calf No.	Rate of Gain	Efficiency	Calf No.	Rate of Gain	Efficiency	Calf No.	Rate of Gain	Efficiency
15	.53	2.59	10	.72	2.16	7	1.08	2.29	11	.60	2.60
18	.62	2.93	23	.62	2.72	16	.77	2.34	13	.75	3.32
21	1.01	2.36	31	.53	3.06	22	.47	3.72	38	.95	2.00
62	1.00	2.12	36	.62	2.90	27	.80	2.38	41	.83	2.51
64	1.13	1.82	44	.88	2.49	30	.83	2.51	42	1.25	1.81
40	.78	2.18	54	.83	2.16	37	.82	2.57	49	.95	1.73
47	.65	2.85	28	.67	3.43	45	.73	2.36	63	1.15	1.99
						53	1.10	2.01	52	.65	2.85
						60	.92	2.15			
Average	.82	2.41		.70	2.70		.84	2.48		.89	2.35

(Continued on Page 108-a)

[1]Efficiency of feed utilization is on the basis of pounds feed per pound of gain. Both the reconstituted (liquid) whole milk and synthetic milk were computed on the basis of 13% solids.

Not all of the 62 calves on experiment are herein reported. All will be reported in due time, and the results will be submitted to statistical analyses.

(Continued from Page 108)

TABLE I

Rate and Efficiency of Gain of Calves Fed Dried Whole Milk Vs. Synthetic Milk, Each With and Without Terramycin[1]

Synthetic Milk						Synthetic Milk + Terramycin					
Male			Female			Male			Female		
Calf No.	Rate of Gain	Efficiency	Calf No.	Rate of Gain	Efficiency	Calf No.	Rate of Gain	Efficiency	Calf No.	Rate of Gain	Efficiency
3	.80	2.59	2	.88	2.33	65	.90	2.06	33	.77	2.00
8	.68	2.41	35	.80	2.39	59	1.25	2.08	24	.62	3.40
14	1.03	1.23	61	.68	2.66	29	.62	2.52	57	.63	2.51
17	.48	3.49	66	.70	2.34	25	.62	2.84	9	.88	1.38
26	.77	2.48				43	1.07	1.72	12	.77	2.31
34	.68	2.16				56	1.07	2.55			
58	.98	2.34				1	1.02	1.68			
50	1.03	2.23				19	.70	2.27			
	.81	2.37		.77	2.43		.91	2.22		.73	2.32

[1]Efficiency of feed utilization is on the basis of pounds feed per pound of gain. Both the reconstituted (liquid) whole milk and synthetic milk were computed on the basis of 13% solids.

Not all of the 62 calves on experiment are herein reported. All will be reported in due time, and the results will be submitted to statistical analyses.

In addition to the milk, the following feeds were provided free choice from birth.

1. Alfalfa hay, second cutting.

2. A "calf starter" ration consisting of the following:

Ingredient	Pounds
Corn, ground	200
Barley, ground	150
Oats, ground	200
Linseed oil mean	180
Millrun	100
Dehydrated alfalfa, ground	50
Steamed bone meal	10
Iodized salt	10

At 30 days of age, bottle feeding was discontinued and the calves were placed entirely on dry feed. After 30 days of age, the diet consisted of (1) dry whole milk or dry synthetic milk, in keeping with the experimental design, (2) hay, free choice, and (3) calf starter, free choice. The dry whole milk or dry synthetic milk, respectively, are mixed with the calf starter (in such proportions as to limit their daily consumption to the same rate as was given when the reconstituted (liquid milk contains 13% solids) milk was fed; namely, 1 pound of liquid milk to 10 pounds of body weight).

The terramycin is fed orally (mixed in the milk) at the rate of 25 mg. daily per 100 pounds body weight.

Results and Discussion

The results at the end of the first 60 days are reported in Table 1.

As would be expected, the efficiency of feed utilization in young calves is very high. It is noteworthy, however, that the average daily gains during the first 60 days were less than one pound, whereas subsequent to this period average daily gains of 1 1/4 to 2 pounds are being secured. The rather modest average daily gains during the first 60 days is attributed to the almost inevitable (1) diarrhea (or scours) which was encountered at about 14 days of age and which persisted for a period of 3 to 10 days, and (2) loss in feed consumption and gains in the 2 to 3 weeks transition period from bottle (liquid) feeding to dry feeding at the end of the first 30 days.

Only one death loss has been encountered. One calf died at 5 days of age, but the veterinarians diagnosed the condition as white muscle disease (obviously not caused by the diet fed to the calves).

On July 16, 1953, the third consecutive clean herd test for Johne's disease was secured in the beef cattle at the State College of Washington. Thus, the herd is now considered free of Johne's disease and the quarantine has been lifted.

It is too early to evaluate the experimental feeding program which is being followed on the calves. However, it is evident that calves can be successfully raised way from their dams when fed the diets indicated.

Conclusions

At this time, only one conclusion can be reached; namely, Johne's disease can be eliminated very rapidly from a herd by (1) raising calves away from their dams, 2 (conducting a 90-day test and slaughter and/or isolation program, and (3) following a rigi program of sanitation and disease prevention.

Further, results on the experimental feeding program of the calves will be reported at a later date.

Future Plans

Recently, the Charles Pfizer and Co., Inc. discontinued providing synthetic milk. As a result, the experimental program on the 62 calves, as designed, will be terminate when all calves reach 180 days of age. However, it is planned to redesign the study and to carry the calves on feeding tests until they are 12 months of age; perhaps (1) continuing to evaluate antibiotics, and (2) studying pelleted vs. non-pelleted rations

I^{131} Tracer Doses and Thyroid Activity as a Measure of Efficiency of Feed Utilization of Beef Cattle[1]

by

M. E. Ensminger and M. W. Galgan

Unfortunately, production testing in all classes of animals is slow, cumbersome, and often expensive--despite its acknowledged virtues, and necessity for maximum progr

For these reasons, much time and expense could be saved and production testing would be greatly popularized if (1) animals could be production tested soon after birth, (instead of the 7 to 12 month period now used), and/or (2) some simple way of determining efficiency of feed utilization could be perfected (without the cost and labor involved in feeding trials of five months duration). To this end, this experiment is being conducted.

This study is designed to determine if a relationship exists between thyroid activity as evidenced by uptake of I^{131} and (1) efficiency of feed utilization, and (2) protein-bound iodine.

Animals and Treatment

In another phase of the WSC Beef Cattle Production Testing Program, 62 calves are available upon which feed efficiency from birth is being determined. These animals are being subjected to the following treatments:

1. Tracer doses of I^{131} given to each of the 62 calves at 3 to 4 month intervals, beginning on June 2, 1953.

2. The percent of uptake of the tracer doses compared to (1) the efficiency of feed utilization, and (2) the protein-bound iodine.

On June 2, 1953, one pellet spiked with 100 uc of Radioiodine I^{131} was administered[2] to each calf, following which--at four hour intervals for 48 hours after I^{131} administration--the thyroids were monitored externally with an ion chamber and the uptake values determined.

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[1] This is part of a cooperative program with the Biology Section, Radiological Sciences Department.
The half-life of I^{131} is 8 days

[2] Pellets given orally by Major C. M. Barnes and Mr. D. E. Warner, Biology Section, Radiological Sciences Department, General Electric Company (Atomic Energy Commission), Richland, Washington. These scientists also monitored the thyroids.

TABLE II

Thyroid Uptake of I^{131} in Calves, June, 1953

Whole Milk

Male						Female					
	Hrs. after administration of I^{131}						Hrs. after administration of I^{131}				
Animal No.	18hrs.	24hrs.	31hrs.	37hrs.	Highest Uptake in %	Animal No.	18hrs.	24hrs.	31hrs.	37hrs.	Highest Uptake in %
15	2.5	3.0	3.0	3.0	3.0	10	3.5	3.0	3.5	4.0	4.0
18	3.5	5.0	5.5	6.5	6.5	23	2.0	2.5	3.0	5.0	5.0
21	1.5	1.5	2.0	3.0	3.0	28	4.0	4.5	6.0	6.0	6.0
62	3.0	3.5	3.0	4.5	4.5	31	6.0	7.0	8.0	8.5	8.5
64	0.5	2.0	1.5	2.5	2.5	36	2.5	2.0	3.0	2.0	3.0
40	2.0	3.0	2.5	4.0	4.0	44	3.0	2.0	3.5	4.0	4.0
47	2.0	1.5	2.0	2.5	2.5	54	2.0	2.5	2.5	3.5	3.5
						55	1.5	2.5	2.0	4.0	4.0

Synthetic Milk

3	1.0	1.0	1.0	1.5	1.5	2	1.5	0.5	0.5	0.5	1.5
8	1.0	1.5	1.0	1.0	1.5	32	1.5	0.5	1.5	0.5	1.5
14	1.5	1.0	1.0	2.0	2.0	35	1.5	1.5	1.0	1.5	1.5
17	1.0	1.0	0.5	1.0	1.0	61	4.0	4.0	4.0	4.0	4.0
26	1.0	1.0	1.0	0.5	1.0	66	2.0	2.5	2.0	2.0	2.5
34	2.0	1.5	1.0	2.0	2.0						
50	1.0	1.0	1.0	2.0	2.0						
58	1.0	1.5	1.5	2.0	2.0						

(Continued on page 111a)

(Continued from Page 111)

TABLE II

Thyroid Uptake of I^{131} in Calves, June, 1953

Whole Milk + Terramycin

Male						Female					
Hrs. after administration of I^{131}						Hrs. after administration of I^{131}					
Animal No.	18hrs.	24hrs.	31hrs.	37hrs.	Highest Uptake in μc	Animal No.	18hrs.	24hrs.	31hrs.	37hrs.	Highest Uptake in μc
7	3.0	2.5	4.0	5.0	5.0	11	4.5	6.5	8.0	8.0	8.0
16	1.5	2.0	2.5	3.0	3.0	13	6.0	7.5	8.0	7.0	8.0
22	1.5	1.5	1.0	2.0	2.0	38	2.0	1.5	1.5	2.5	2.5
27	1.0	2.0	1.5	3.0	3.0	41	6.5	6.0	9.0	7.5	9.0
30	2.0	2.5	2.5	3.5	3.5	42	1.5	1.0	1.0	1.5	1.5
37	4.5	3.5	4.5	5.0	5.0	49	1.5	3.5	2.5	3.0	3.0
45	2.0	1.0	2.0	2.0	2.0	52	2.0	2.0	2.0	2.0	2.0
53	2.0	2.0	2.0	2.0	2.0	63	2.0	3.0	3.0	3.0	3.0
60	3.0	2.5	6.0	5.0	6.0						

Synthetic Milk + Terramycin

1	1.5	1.0	0.5	0.5	1.5	9	2.0	1.0	0.5	2.0	2.0
19	2.0	2.0	2.0	2.0	2.0	12	1.0	1.0	1.5	1.0	1.5
25	1.0	1.5	1.5	2.0	2.0	24	1.5	2.0	1.5	2.0	2.0
29	2.0	1.5	1.5	3.0	3.0	33	1.5	1.0	1.5	1.5	1.5
43	1.5	1.0	1.5	2.0	2.0	57	2.0	2.0	1.5	2.0	2.0
56	1.0	1.5	1.5	2.0	2.0	48	1.5	1.5	2.0	2.0	2.0
65	1.5	2.0	2.5	2.0	2.5						

Results and Discussion

The results are reported in Table 2.

Since this represented our first attempt to administer I^{131} to calves and to monitor their thyroids, we feel that we can and will improve upon the technique as time progresses.

At this time, no attempt is made to correlate the percent of uptake of the tracer doses to (1) the efficiency of feed utilization, and (2) the protein-bound iodine (which has not been determined to date). It is at least interesting to note the following facts relative to the first I^{131} treatment:

1. When monitored externally with an ion chamber, the following ranges in uptake values were obtained:

uc in Thyroid	No. of Animals
0 - 2.5	34
3-6	21
6-9	5

2. The majority of the animals reached a maximum uptake value 37 1/2 hours after administration of the isotope.

Future Plans

Each calf will be given a second tracer dose of 100 uc of I^{131} between September 1 and September 15, 1953, and again at each of two 3 to 4 month intervals subsequent thereto, and the percent uptake of the tracer dose in the thyroid will be determined.

Pelleted vs. Non-Pelleted Rations for Beef Cattle

by

M. W. Galgan and M. E. Ensminger

Western stockmen are partial to pellets or cubes for cattle and sheep, especially for range feeding. Among the most common reasons advanced in favor of pellets are the following:

1. Pelleting reduces losses from wind blowing--an important factor in the range.

2. Pelleting alleviates wastage of relatively unpalatable feeds.

3. Pelleted feeds are less bulky and easier to store and handle, thus lessening storage and labor costs.

4. Pelleting prevents animals from selectively wasting ingredients likely to be high in certain dietary essentials; each bit is a balanced fee.

Points 3 and 4 above are especially pertinent in programs designed to measure the efficiency of feed utilization of beef cattle.

In the winter of 1952-53, an all-pelleted ration (including both concentrate and roughage) was used in the bull testing program conducted by the Whitman County (Washington) Beef Cattle Production Testing Association. The all-pelleted ration was fed throughout the trials and was most successful. However, because of the lack of bulkiness to the total ration, many good cattlement were prone to attribute the occasional digestive disturbance or other feeding problems to the fact that an all-pelleted ration was used. Such questions prompted the feeding trial herewith reported.

Animal and Ration

Thirteen heifers averaging 290 days in age were placed on trial December 30, 1952; six on a non-pelleted (ground) ration and seven on an all-pelleted ration. The rations were self-fed (in individual self feeders) by allowing free access to the respective feeders twice daily, for a one-hour period each time. The ration consisted of the following ingredients:

Ingredient	% by weight
Grass hay	15.85
Alfalfa Hay	15.85
Oats, ground	15.85
Corn, ground	26.65
Linseed oil mean	3.75
Soybean oil mean	5.00
Cottonseed oil meal	2.30
Beet pulp	9.50
Molasses	5.00

In each case the ration was the same except in preparation; one group received an all-pelleted ration and the other group a more conventional ground mix.

In addition, the animals were allowed free access to a double compartment mineral box, with ground iodized salt in one compartment and a mixture of 1/3 ground iodized salt and 2/3 steamed bone meal in the other.

The feeding trial was continued until May 19, 1953 for a total of 139 days.

Results and Discussion

The results are summarized in Table 3.

The herdsman reported that he observed no differences in the groups from the standpoints of getting the animals on feed, digestive disturbances, and general health.

Analysis of variance[1] revealed the following:

1. There was no significant difference in the daily rate of gain between the two groups.
2. There was a highly significant difference in the efficiency of feed utilization (the pounds of feed required per 100 pounds gain) between the two groups. As noted, the non-pelleted group required an average of 905.2 pounds feed per 100 pounds gain, whereas the pelleted group required 710 pounds of feed per 100 pounds gain; a feed saving of 195.2 pounds per 100 pounds gain in favor of pelleting.

Conclusions

Because of limited numbers, the results of this study should be considered as indicative but not conclusive.

The indications are:

1. That from the standpoints of health and gains, beef cattle may be fed an all-pelleted ration (including both the concentrate and the roughage) as successfully as a more conventional ground (non-pelleted)ration.

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[1] Statistical analyses were made by Miss Mary Ann Cipolloni, Experimental Aide, Department of Animal Husbandry, State College of Washington

2. That an all-pelleted ration makes for less labor, greater ease of storage, and greater efficiency of feed utilization.

Future Plans

Future studies of pelleted vs. non-pelleted rations will be conducted.

COOPERATORS

Cooperative Program with Whitman County Beef Cattle Production Testing Association

by

Charles Kyd, M. W. Galgan, and M. E. Ensminger

In a cooperative program with the Whitman County Beef Cattle Production Testing Association, 53 bulls were individually fed an all-pelleted ration for a period of 152 days.

A "bull day" was held on March 9, 1953, and the results of this program were reported in Washington Station Circular No. 216, a copy of which is herewith attached.

Other Cooperators

by

Charles Kyd, M. W. Galgan, and M. E. Ensminger

A total of 45 purebred and 20 commercial breeders throughout Washington are cooperating in the program. Their on-the-ranch-counsel and supervision is provided by the local County Extension Agents[1], under the leadership of the Extension Livestock Specialist. The WSC Department of Animal Husbandry serves as a place to which to send the records for analysis.

Future Plans

It now appears that three different county groups in Washington may be conducting "bull testing" programs during the winter 1953-54, utilizing their respective county fair buildings.

It is our hope that we may be able to devise ways of getting more complete records and more prompt reports from private cooperators; perhaps in this connection we may be able to borrow some ideas from D.H.I.A. programs.

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[1] Recently, the County Extension Agent of Kittitas County, Washington, Philip Bloom, used the data collected in his county as the basis of a Masters Thesis at Colorado A. & M. College.

TABLE 3

Pelleted Vs Non-Pelleted Ration for Beef Heifers

Calf No.	Breed	Birth Wt. (lbs)	Age.Dec.30 (days)	Wt. Dec.30 (lbs.)	Wt.May 19 (lbs.)	Gain (lbs.)	Ave. Daily Gain (lbs)	Food Consumed (lbs)	Efficiency (lbs feed 100 lbs. gain)
Non-Pelleted:									
51	Angus	83	309	581	890	309	2.22	2099	679.3
66	Shorthorn	68	303	488	662	174	1.25	1997	1147.7
52	Angus	56	288	480	660	180	1.29	1829	1016.1
42	Angus	52	260	437	630	193	1.39	2020	1046.6
56	Hereford	61	258	510	740	230	1.65	1893	823.0
44	Shorthorn	72	295	558	800	242	1.74	2183	902.1
AVERAGE		65.3	285.5	509.0	730.3	221.3	1.61	2003	905.2
Pelleted:									
52	Shorthorn	73	310	540	790	250	1.80	1748	699.2
56	Angus	66	293	482	685	203	1.46	1457	717.7
182	Angus	58	304	500	720	220	1.58	1542	700.9
53	Hereford	64	292	565	805	240	1.73	1667	694.6
60	Shorthorn	68	298	545	775	230	1.65	1611	700.4
10	Angus	54	280	492	685	193	1.39	1172	607.3
112	Shorthorn	80	280	624	830	206	1.48	1752	850.5
AVERAGE		66.1	293.9	535.4	755.7	220.3	1.58	1564	710.0

W- ANNUAL REPORT FOR THE PERIOD July 1, 1952 to June 30, 1953
Regional Beef Cattle Improvement Project

1. Station: UNIVERSITY OF WYOMING

2. Title of Project: Improvement of Beef Cattle Through the Application of Breeding Methods

3. Personnel: (Technical) P. O. Stratton, N. W. Hilston, C. P. Stroble

4. Animal Inventory:

Laramie Station	Females	Males	Totals
Herefords:			
2+ years	38	1	
1-2 years	11		
calves	12	22	84
Shorthorns:			
2+ years	44	1	
1-2 years	5		
calves	12	22	84
Angus:			
2+ years	16	2	
1-2 years	8		
calves	5	4	35
Gillette Station			
Herefords:			
2+ years	28	1	
1-2 years			
calves	11	11	51

5. Facilities: (Land, buildings, equipment) (1952-53)

Land - $37,500 (1500 acres range at $15.00; 100 acres station at $150.00)
Buildings - $16,650.00 (sheds, corrals, feed storage)
Equipment - $9000 (farm and laboratory)

6. and 7. Nature and Extent of Work done this year and Principal results

Data as outlined in the project procedure have been obtained for the University farm animals and Gillette herd. The University herd has been transferred to a more practical basis, whereby all animals will be useful in the W-1 project. Facilities are now available to individually feed all progeny for performance data. All breeds will calve in early spring rather than year around.

(1) Blood Typing:
There have been a total of 664 beef animals blood typed from eleven stations over the Western region. Of this total, 614 are being used in a study to determine if there may be some association between blood groups and feed lot performance. Performance records have been received from cooperating stations and the data are being analyzed.

6 and 7. Natures and extent of work done this year and principal results, cont.

(1) With few exceptions the entire Laramine beef herd has been blood typed. Attempts will be made to determine associations if any, of certain blood groups and readings made of the herd with the profilometer. A similar study will be made for those animals on which we have profile readings in the previous study.

One parentage problem has been clarified by blood typing which had considerable bearing on the profilometer classification of the animal in question.

(2) Feed Trials:
Facilities became available to individually feed 18 steers early in 1953. The study was somewhat a trial run since there was considerable variation in age on feed, but the study has been helpful in establishing management technique. Some benefit, as an aid to selection of dams, resulted.

Our facilities have been increased so that all the 1953 calf crop may be individually fed. At the close of the 168 day feed trial, sample individuals will be slaughtered and their carcasses evaluated. Individual performance data and carcass dat of relatives will be used as an aid to selection.

At the Gillette Station, 16 first calf heifers were divided into two groups to determine the effect of light and heavy protein feeding on calving.

(3) Combining Ability
A performance tested Line I Hereford sire was purchased from the Miles City Range Station this spring. He has been mated to the entire University herd for a test of combining ability of Montana Line 1 Herefords with an outbred population. In addition ten head of grade cows from an outstanding commercial herd west of Laramie were recently purchased and have been mated to the Line I bull. This commercial herd was developed and has been maintained for 25 years using sires from a highly inbred registered herd, closed for six generations. The combining ability of these two inbred lines will be measured.

(4) Profilometer Tests:
There have been 1000 head of Hereford cattle profiled in the state during the last fiscal year. In cooperation with Dr. Gregory and the B.A.I. office the data from these profiles have been used to help develop a means of classification and used as a check on the accuracy of the classification of animals by the profilometer. Some of this data, in cooperation with the B.A.I. office, is being reworked in an attempt to develop a method of classifying bulls at a younger age.

Considerable time has been spent in an effort to develop a method of discriminating carrier and clean Hereford cows. Female profiles taken by Dr. Gregory and Dr. Roubicek have been made available for this study and are being used along with those in our files for analysis.

(5) Antipyrine Tests
Work is being continued in an attempt to estimate body fat from measurement in vivo of body water by the use of antipyrine. Data will be taken on three mature animals this summer. Animals will be slaughtered and comparisons made for analysis.

8. Application of results and benefits realized:

Considerable interest has been aroused over the entire state regarding the dwarfism problem as indicated by the increased requests for profiling. Also more breeders are making use of the performance testing program handled in cooperation with the Extension Department.

9. Work planned for next year:

Continuation of present procedure.

10. Project expenditures the past year, broken down by funds - Federal, State and other funds such as grants:

funds	Salaries	Wages	Livestock Purchases	Feed	Buildings Equipment	Travel	Total
10b	----	---	----	---	----	----	---
9(b)3	1540.00	225.00	----	735.00	----	400.00	2900.00
9(b)1-2	3591.00	779.00	----	---	705.57	----	5075.57
State	3340.00	360.00	----	14268.48	7477.56	1578.39	27024.43
Grants	----	---	2745.00	---	----	----	2745.00
Total	8471.00	1364.00	2745.00	15003.48	8183.13	1978.39	37745.00

BEEF BREEDING PROJECT SUMMARY
Fiscal Year 1952-53

State Wyoming
Date July 1, 1953

I. Cattle Inventory

A. Purebreds

Line designation	[illegible]	[illegible]	[illegible]	[illegible]
Breed	Hereford	Hereford	Short.	Angus
Station	Laramie	Gillette	Laramie	Laramie
Bulls (12 mo. or over)	1	1	1	2
Cows (2 yrs. or over)	34	28	44	16
Heifers, yearlings	5		5	8
Male calves	20	11	22	4
Heifer calves	10	11	12	5
Percentage use for Breeding project	100%	100%	100%	100%
Estimated cash value	$12,440	$8,500	$14,940	$7,185

B. Grades

Line designation	D1				
Breed	Hereford				
Station	Laramie				
Bulls (12 mo. or over)					
Cows (2 yrs. or over)	4				
Heifers, yearlings	6				
Male calves	2				
Heifer calves	2				
Percentage use for breeding project	100%				
Estimated cash value	2,500				

III. Additions of land, physical facilities and equipment during fiscal year 1952-53.

Item	No.	Actual Cash Value	Percentage use for beef breeding project	Remarks
Pasture land	289 acres	$1000.00		Rented from dairy until new dairy farm completed
Crop land for pasture	110 acres	550.00		Rented from dairy until new dairy farm completed
Feed mixer	1	675.00	100%	
Hay maker	1	1268.00	75%	
Forage Harvester	1	2749.60	30%	
Glassware		127.00	75%	
Wasserman racks	12	192.96	100%	
Centrifuge	1	60.00	100%	
Lyopholizer	1	250.00	75%	
Kooler box	1	30.00	100%	
Photographic equipment		100.00	100%	
Profiling paper		100.00	100%	
Profilometer	1	250.00	100%	
Rabbits	13	50.00	100%	
Neck chains	60	75.00	100%	

II. Young animals which were on feed during 1952-53

A. Purebreds

	Herefords		Angus		Shorthorns	
	Number individually fed	Number Group Fed	Number Individually Fed	Number Group Fed	Number Individually Fed	Number Group Fed
Bulls						
Heifers		16				
Steers	6		1		11	

B. Grades

Bulls						
Heifers						
Steers						

IV. Funds expended during fiscal year 1952-53 (make estimates for remainder of year)

Source	Amount Non-recurring items	Amount Operating expense
9b3		$3,500.00
BAI funds		none
State-controlled funds	$7,477.56	$24,022.44

The committee then took up the various state reports. The discussions on each report were as follows:

Discussion following Arizona Report.

A discussion of procedures to use in scoring followed the Arizona report. Mr. Safley elaborated on the following points:

1. Have a record available so that when a calf is scored the previous record of the dam may be considered.

2. Condition is estimated by visual methods. A prime animal taken from individually fed animals is used as the standard.

3. Judges discuss the first two or three animals so that they can start on common ground.

4. The grading system used is a plus and minus through four major classes making a total of 12 grades.

Mr. Safley then presented a formula for branding fluid. This fluid can be prepared and taken to the field in bottles. It colors the hair black and will remain for the life of the hair.

NYANZOL D lumps may be obtained from:

Myanzol Color Company
549 W. Randolph
Chicago, Illinois

The cost is about $1.75 per lb.

Mix:

9 oz.	N. D. L.
16 oz.	hydrogen peroxide
8 oz.	gum arabic

Dissolve N.D.L. in hot water.
Dissolve gum arabic in cold water.
Combine these two solutions and then add the hydrogen peroxide just prior to use.

Discussion following California Report.

The difficulty of properly classifying stillborn calves or those that died before one month of age was discussed. It was agreed that these early calf losses must be considered when a bull is being progeny tested. A complete autopsy report should be obtained whenever possible, and measurements of the calf should be taken so that as procedures for properly identifying dwarfs are developed these calves can be accurately classified.

Dr. Gregory was questioned regarding the percentages of bulls which profile clean or carrier. Dr. Gregory stated that he did not have total figures but in individual herd studies he has found an extremely high incidence of bulls with carrier profiles. He explained that these numbers were undoubtedly due to the early selection of carrier bulls as eventual herd sires.

Dr. Ensminger then brought up the consideration that even if clean bulls were used by a breeder he would probably select back to carriers.

Dr. Gregory discussed the probable prevalence of the dwarf gene in the population and pointed out that his records show that the gene has been with us a long time.

The value of obtaining profiles on 6 months calves to permit at least a preliminary classification was also discussed. Dr. Clark explained that information that had been shown to him indicates that animals at young ages do show expression of the gene, however sufficient data are not available yet to permit field use of the method.

Dr. Gregory further emphasized the points brought out in the California report regarding progeny tests of bulls. Care should be used in accepting a rancher's statement that a bull has been proven clean or carrier, and records should be carefully studied before the proving is accepted.

Meeting adjourned at 5:00 p.m. and reconvened at 8:00 a.m., Saturday, July 25. Dr. Stonaker presented the Colorado report.

Discussion following Colorado Report.

Dr. Stonaker explained that the comprest line was not included in his formal report. He stated that out of 45 calves from comprest x comprest matings 16 to 18 were dwarfs. The remaining 27 to 29 were mostly of comprest type although normals were also present. Dr. Stonaker also described the hydrocephalic calves that were obtained from Real Prince bulls at the Akron Ranch. These heads have been turned over to Dr. Gregory.

Dr. Stonaker also discussed some of the undesirable traits which are now appearing in some of the inbred lines at Ft. Lewis, including spastics, infantile ovaries and hyrdrocephalus. A calf from the Prospector (Fort Lewis) line was diagnosed as a dwarf by Dr. Gregory who used his personal observation of this calf at Fort Lewis, head profile, and Colorado A. & M. veterinarian autopsy report for his classification. Dr. Stonaker said that measurements of the calf fell well within the range of his normal calves and he could not consider the animal a dwarf.

Dr. Stonaker listed the profile classification of 12 bulls from the Fort Lewis lines. Eight of the bulls showed carrier profiles. He then explained to the group that the possibility of having such a large percentage of carrier bulls without more evidence of dwarfism in the lines made him view the results of the profilometer with skepticism until more evidence was available.

He added "In Dr. Gregory's and Dr. Roubicek's analysis and presentation the profiles of control ++ bulls are included on a family basis as well as a progeny test basis. Doctors Roubicek and Stonaker collected the data on the Fort Lewis cattle in December 1952 partly because of the history of freedom from dwarfism in these inbred lines and it was felt they would serve as useful control material. It was only when the cattle profiles did not fit into the pattern of prediction that they were discarded as being of no use to the profilometer study. Since other bulls were included in the control group on a family basis it is obvious that the discarding of evidence on Fort Lewis lines is post facto selection of the data."

In reply to questions, Dr. Stonaker explained that none of the animals from the Fort Lewis lines has had a sufficient progeny test to reach a significant probability level. The older bulls that had been mated to a number of their own daughters were no longer available for profiling.

Comparison of D. F. 2 values of Fort Lewis bulls.

Bull Number	Dec. 1952 value	May 1953 value
06	+1.33 (++)	+1.03 (++)
010	-5.54 (+d)	-7.65 (+d)
062	-4.10 (+d)	-6.11 (+d)
0144	-5.98 (+d)	-5.15 (+d)
0180	+1.05 (++)	-1.83 (++)
204	-2.05 (+d, o.l.)	-5.09 (+d)
232	-2.18 (+d, o.l.)	-3.55 (+d)
290	+0.9 (++)	-1.07 (++)
292	-2.42 (+d, o.l.)	-2.78 (+d)
300	-7.78 (+d)	-8.12 (+d)
1238	-5.94 (+d)	-5.8 (+d)
1205	Type I	Type I

Dr. Gregory pointed out that the genotypic predictions shown in Table 1 of the Colorado annual report were prepared by Dr. Stonaker based on the original key. Since discriminant functions were now being used exclusively he stated that the discriminant values of the profiles should be used for comparison rather than the classification as shown in the Colorado annual report.

Dr. Stonaker also described progeny tests he has set up for three of the Fort Lewis bulls.

1. Prospector bull
   a. Mated to 10-12 proven carrier cows
   b. Daughters of proven carrier bulls
   c. Daughters of bulls with carrier profiles
2. Royal bull
   Same as Prospector bull above
3. Colorado bull
   Eventually a series of sire-daughter matings and mating to daughters of bulls with carrier profiles.

There was further discussion concerning the possible connection of hydrocephalus and dwarf. There was general agreement that a competent anatomist should study the head and possibly the foreleg to properly classify a very young calf. Reference was made to the Arizona (Pahnish) report that the majority of the dwarfs are hydrocephalic.

Discussion following Hawaii report.

Mr. Flower questioned Dr. Wayman regarding the interchange of breeding stock with the Territory. Dr. Wayman explained that there was considerable movement of breeding stock, both between Territory residents and actual foreign or mainland importation. The introduction of breeding stock has been rather continuous, but Dr. Wayman stated that he did not know of a single dwarf that had been born in the Islands. He considered some of the Territory herds an excellent opportunity to profile dwarf-free bulls. Mr. Bennett asked if the plan for Hawaii is to set up inbred lines. Dr. Wayman said that the plan did call for inbred lines but their program was subject to the cooperation of the ranchers and it was necessary to use a rather careful approach in some cases.

Discussion following Idaho Report.

The discussion was centered around the use of pelleted rations for efficiency testing. Dr. Sierk clarified the following points:

1. Those animals using pelleted rations do use feed more efficiently.
2. There is an actual difference in feed intake of animals on pelleted and non-pelleted feed.
3. Differences are not due to wastage.
4. Some difficulty with rumination was noticed for animals on pelleted feed.

Discussion following Montana Report.

Some of the problems involved in putting ROP information to practical use were discussed. Mr. Willson stated that they were encouraging breeders to test adequate numbers of progeny from bulls that had previously been "indexed." The necessity of station personnel working closely with Extension in this work was emphasized.

Discussion following Nevada Report.

Dr. Kidwell emphasized the need for cataloging individual genes for beef cattle. Other genes besides the dwarf gene should be given consideration. When questioned about the work they were doing at the Nevada Station with antipyrine Dr. Kidwell explained that to date the work has been chiefly for standardization. They are using sheep for these preliminary trials.

Discussion following New Mexico Report.

Dr. Durham elaborated on the work they were doing at New Mexico on their studies of hide area.

Dr. Durham emphatically stated that he thought all popular-type articles should be reviewed by the Technical Committee before they were published. He

referred specifically to an article on dwarfism appearing in Farm Journal early in 1953. In the discussion which followed, both Dr. Clark and Dr. Roubicek stated that the article was not written by them, but that the correspondent whose name appeared on the article was the author. The information obtained from the Denver Office was essentially the same as had appeared in the California W-1 annual report for 1952. Dr. Byerly defended the farm press, explaining that a great deal of research information was reaching the industry quickly by means of popular releases.

Dr. Durham also suggested that a resolution be formulated stating that the Regional Coordinator send a periodic report to the Technical Committee reporting on work being done at the various stations. This suggestion was discussed and some of the difficulties involved in such a plan were brought out. No action was taken on the proposed resolution.

Further discussion was generally concerned with profilometer results at New Mexico and the general problem of ranchers disposition of carrier bulls. Dr. Durham stated that a bull which he had profiled and had been classified as a non-carrier by Dr. Gregory later proved to be a carrier. On the basis of this bull he thought the profilometer technique should be approached cautiously. Dr. Gregory then briefly reviewed the profilometer work that had been done with the New Mexico station. He stated that the first profiles turned in by Durham were poor and really should never have been used in predictions.

Dr. Byerly and Dr. Wheeler emphasized the need for keeping confidential the names of ranches when discussing the dwarf problem. Dr. Clark explained the procedure that had been used in the Denver Office and pointed out that ranchers had expressed genuine appreciation to him for the fact that he had kept the information on a "classified basis" and no leaks had occurred to date.

Discussion following Oregon Report.

Dr. Bogart was questioned about the hormone work that had been done at Oregon. He stated that he did not know if there was a residual effect of the hormone in the meat, although it was a question that would have to be answered. He also explained that no positive effect of testosterone could be found if it were fed instead of injected. This could be due to dosage rather than just the fact that it was fed.

Discussion following Utah Report.

Mr. Bennett displayed the results of the chromatography study now underway at Utah. Three dwarf and 14 normal females have been tested so far. Initial results of studying amino acids in the urine indicated a relatively large amount of one of the amino acids (probably glutamic) in the urine of the dwarf calves.

Mr. Bennett also stated that he had only trouble to report from the anti-pyrine work that had been done at that station.

Discussion following Wyoming Report.

The problem of what individual ranchers should do with carrier animals was discussed at length. Dr. Stratton felt that if the rancher had his records available to anyone interested in the cattle the final decision was still up to the purchaser. Dr. Durham stated that he condemned all breeders who sold carrier animals and that Mr. Knox (New Mexico) was very much concerned that carrier animals would be sold to commercial operators. Dr. Clark and Dean Briggs pointed out that if all carrier animals were eliminated there would be an acute shortage of bulls. Dr. Durham advocated that commercial operators should raise their own bulls for replacement in their herds.

Dr. Gregory explained that when he was after research information he did not question what the operator did with his animals. Dr. Byerly stated that the dividing line between research and service was difficult to define and that the disposition of carrier animals would have to be the concern of all of us. Dr. Stonaker and Dr. Bogart indicated that it would be necessary for experiment station and technical personnel to help the rancher in selecting dwarf-free breeding stock and still retain the desirable genes in the herd.

Dr. Byerly brought up the 11 point recommendation of the June 8 and 9 dwarfism meeting in Denver and asked for an expression of opinion. Dr. Stonaker suggested modifying the first point to include the statement that the data as used in establishing the discriminant functions excluded bulls (Ft. Lewis) which had as much right to be in the non-carrier category as some of the animals so included. He approved the other recommendations as written.

Report and discussion of the Regional Coordinator.

Dr. Roubicek opened the discussion by presenting the possibility of using standard forms and procedures and then pooling the data of the various states for the dwarf study.

Based on the assumption that the states would individually take and process all of their own profiles, the following points were brought up for consideration:

1. All research work would be handled through W-1 project leaders.

2. Standardized forms would be used by the respective states for summarizing all profile data and for use in correspondence with ranchers.

3. Standard forms would be available for the rancher to fill in and return to the state showing proving of animals.

4. All data of research value, including information on proven animals as well as data on young animals as well as animals of other breeds would be made available by the states for pooling.

5. All changes and refinements in technique would be made immediately available to the states without waiting for formal publication.

Dr. Byerly suggested that some states may feel they have sufficient research data and would object to sending their data to other states for analysis. He felt that state project leaders who are willing and able to analyze their own data be allowed to do so.

Dr. Stonaker asked for clarification regarding the accumulation of data, if it were extension service or research data we were concerned with. Also if profiles would continue to be sent to Denver. It was pointed out that we were concerned with research data but that the 11 point recommendation from the Denver meeting asked that the extension service assist in obtaining some of these data. Dr. Clark explained that the procedure for handling profiles at the Denver office was not established pending final action of the Extension Directors at the Bozeman meeting but that a technician was now available at the Denver office to train state workers on profile interpretation.

Dr. Stonaker asked who would decide if data were accurate as they were sent in for pooling from a state. Dr. Roubicek stated that the proving for each animal should be a part of the record and the state project leader would review the data before considering submitting them for pooling. Dr. Stonaker then brought up the problem of profiles which have already been taken in a state and which are in possession of Dr. Gregory. In many cases the state project leader does not have the information on the profiles.

Dr. Byerly said he felt the profiles should be returned to the respective states. Dr. Stratton suggested that the diagnostic values would be adequate and that the profiles could remain at California. Dr. Wheeler suggested that the committee should form a resolution and send it to Director Sharp and Dr. Gregory informing them of this situation. The suggestion was adopted by the committee.

Dr. Roubicek then asked the committee what their wishes were concerning a W-1 workshop. It was explained that this workshop would be set up to facilitate analysis of project data and that some states had indicated a great deal of interest in such a proposal. Dr. Stonaker said that he had checked with the registrar office at A&M and that it could be possible for students to get graduate credit for attending such a workshop if certain graduate school specifications were followed. Dr. Bogart indicated strong favor for the workshop and suggested that W-1 project leaders be present with the graduate students to help in guidance and also to exchange ideas with other workers. The responsibility of formulating tentative plans and attempting to have such a workshop next year was left to the Regional Coordinator.

The Bureau allocation of funds to the states in the western Region was then presented by Dr. Roubicek. The 1953 allotment of 9b3 funds was also listed.

State	Fiscal 9b3	1952-1953 Bureau Funds	Total Bureau Funds Received	Fiscal Bureau Committments
Arizona	2500	1800	9000	1800
California	4600	2800	14000	2800
Colorado	8000	3200	18960	2700
Hawaii	3000	-	-	-
Idaho	5000	-	-	-
Montana	5800	2400	11500	1800
Nevada	3900	-	4666	-
New Mexico	8000	3800	22220	3200
Oregon	8000	3600	26873	3600
Utah	5500	2400	13767	1800
Washington	5000	2400	16500	-
Wyoming	6700	-	-	-

Dr. Ensminger expressed the objection of his station in having their Bureau funds cancelled. He felt that the implication had been left that these funds were to be used to expand the study on dwarfism and since they were not actively engaged in such research their funds had been cancelled. Dr. Roubicek reiterated the points that had been considered in making the reallocations. Namely:

1. Qualified personnel available to devote a large share of their time to concerted research on dwarfism.
2. The present status of the state project with respect to research not directly associated with dwarfism, but which has high potential in important results.
3. The financial status of the project in regard to Bureau allotments in the past and the probability of the project continuing for at least a short period with limited support.
4. The projects most likely to produce maximum returns with increased funds.

Dr. Byerly asked for information concerning proposed allotment of the Bureau funds. Dr. Roubicek explained that two states, Idaho and Wyoming, had never received any Bureau funds and yet have made contributions to the project. Furthermore, the opportunity to establish a regional blood typing laboratory at Wyoming was a definite possibility and worthy of support. He also stated that it could be possible to tie San Carlos in with the Arizona project and this would probably require some financial assistance. It was also necessary to hold about $700.00 in additional funds available for travel and part time help at the Denver office. Dr. Ensminger stated that he had no objection to the proposed allocations to states that have not received help. He then moved that the committee recommend that the cut in Bureau funds to the states be on a percentage-wise basis across the board. Seconded by Stonaker. The motion was not carried.

Dr. Kidwell and Dr. Wayman questioned the purpose of Bureau monies and the basis of their allotment. Dr. Roubicek explained that the purpose of the Bureau monies was to give the states an opportunity to build up inventory and facilities and to permit analysis of data. The aim was to allocate funds on the basis of potentiality or actuality of each state project and not on precedent. Dr. Byerly qualified the statement to state that state projects should be appraised with respect to facilities, personnel, and need, and priority with respect to

quality. He further stated that to give money and then take it away was difficult but that the Bureau reserved the right to allot money to those particular projects deemed worthy by them.

The value of providing Bureau support for the proposed regional blood typing laboratory was discussed. Dr. Wayman and Dr. Kidwell indicated that the Utah work on chromatography merited additional support. Dr. Roubicek pointed out that Utah had developed this work since his visit in May and that he had no previous advice. Dr. Stonaker stated that swarfism studies could not be an important function of the laboratory. Dr. Sierk stated that since the laboratory was already established it should be supported. Dr. Byerly questioned Dean Briggs concerning the status of the laboratory. Dean Briggs stated that without Bureau support the laboratory would operate only to a limited extent and could not do service for other states. The sum of $2500 was established as the amount Dean Briggs considered as a minimum to maintain service work at the laboratory. Mr. Bennett inquired about the increased 9b3 allottment to Wyoming for the W-1 project. He questioned if additional Bureau funds would be required by the station. Dean Briggs explained the increased allotment was a shift of $2000 from another project to W-1 since he felt a greater contribution could be made in W-1 as an overall project than if the increase had been made among several small projects.

Some of the committee members objected to notification of the cut in Bureau funds being received by the station after the state budgets had been made, thereby causing additional difficulty for them. Dr. Wheeler suggested that such notification be sent to the states before the state budgets are made up. Dr. Clark pointed out that the funds we were now discussing were only tentative since he had not even as yet received notification from Washington concerning the funds that would be available for this year.
(Note: The allotment notice was actually received August 10th.)

Summary of Reports from Visitors.
Dr. J. O. Grandstaff

There is a need for a continuing review of existing projects with a view of keeping them up to date. W-1 was one of the first regional projects organized and a good deal of water has gone over the dam since then. We see objectives more clearly today than 5 or 6 years ago and can do a better job of outlining them than when W-1 was first organized. There is need for continuous scrutiny of projects to see if they are up to date. The outlines on file in Washington represent a source of information for Congressional Committees who raise questions about projects and duplication of effort. 9b3 funds do not represent permanent grants to a state. They are subject to review each year and evaluations and justifications must be on the results produced. The state workers see their problems better because they are close to the work. They do not see it from the overall standpoint. In regard to rate and efficiency of gain, as it goes on it will be scrutinized as to whether it is research or a service. The problems considered in this meeting were discussed in a democratic manner, out in the open. The settled problems may not be to the liking of all but they will be just to all concerned.

Dr. R. T. Clark

There are four things I would like to mention:

1. We are committed to a team type of research. This is the only way this type of research can be effective, but you should understand that this type of research is continually under close scrutiny as to whether it is effective or not.
2. We at the Denver office have enjoyed the very real research and industry cooperation that has been built up during the year. The files fully attest to this increased cooperation.
3. Industry is becoming more conscious of the value of research. Many of these people have now become our staunchest supporters. We recognize that there is now available the public support we need to have a more dynamic program.
4. There is a large body of information on IBM cards. Much of this accumulated information has not been analyzed. We will have to address ourselves to these efficient methods of analysis of data. The idea of a work conference I fully subscribe to. Groups coming together and exchanging ideas can be of inestimable value. During the past 6 months especially I have often wished I could bring a number of you to Denver for mutual exchange of ideas.

Dr. T. C. Byerly

This meeting has shown some of the problems with which we are confronted. I will try to understand your problems and will help you in all ways that we can.

Dr. F. F. McKenzie

I have just returned from an extended trip to Australia and I have heard them talk about democracy. Here at this meeting I saw democracy in action that they don't know about at all. The meetings there are not anything like we just had here. They don't even try for pitched battles. I am thankful that we have them here.

The following resolutions were submitted to the Committee and unanimously approved:

Resolved: That the Department of Animal Husbandry, University of Wyoming be commended for the excellent hospitality, intense efforts, and splendid facilities provided for the 1953 meeting of the W-1 Beef Cattle Technical Committee; the members of the W-1 committee are especially grateful for the excellent dinner provided by the members of the Department and the graduate students.

Resolved: That the Technical Committee extend a vote of thanks to Dr. L. M. Winters for his thought-stimulating address and for his taking time to discuss with us problems of mutual interest.

Resolved, that the present backlog of profiles that have been submitted to Dr. Gregory from States other than California be processed as soon as possible by a trained technician at the Denver laboratory, this technician to be paid out of Bureau funds so that the California station will not be burdened by this task. Dr. Roubicek will submit these readings to each individual state in the Western Region that supplied the original profiles. It is further resolved that Dr. Roubicek and Dr. Clark work out a satisfactory arrangement with Director Sharp and Dr. Gregory so that the original profiles or copies of them and copies of the Denver readings on these profiles will be returned to Dr. Gregory for his own research use under mutually agreeable arrangements with the respective states.